SCIENTIFIC AMERICAN

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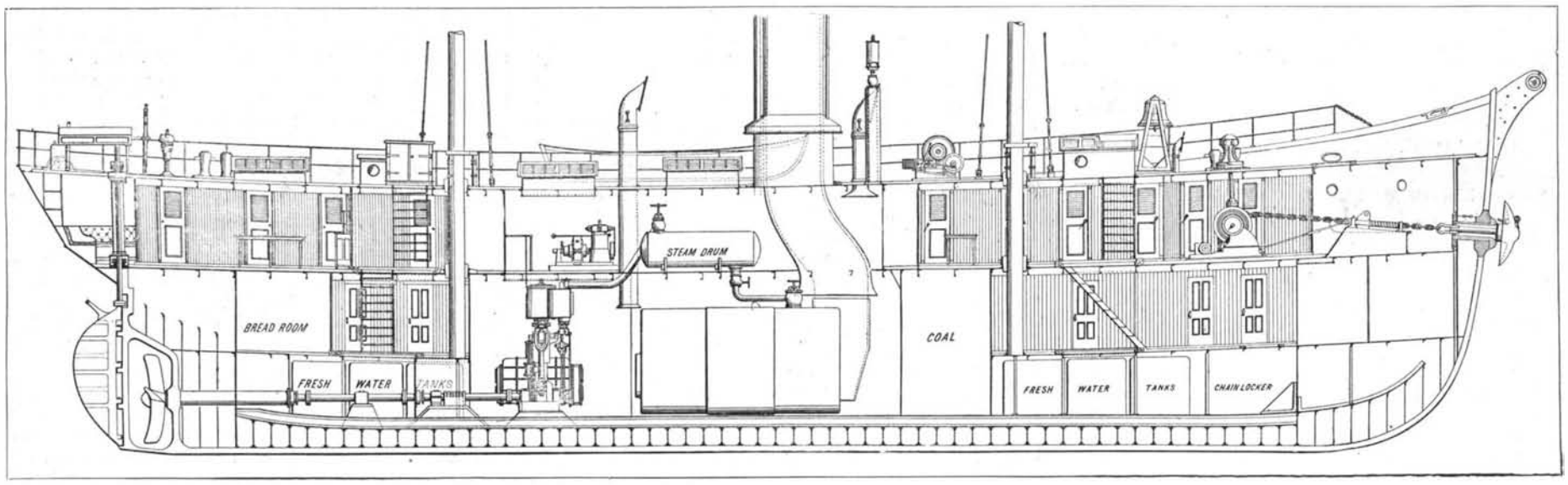
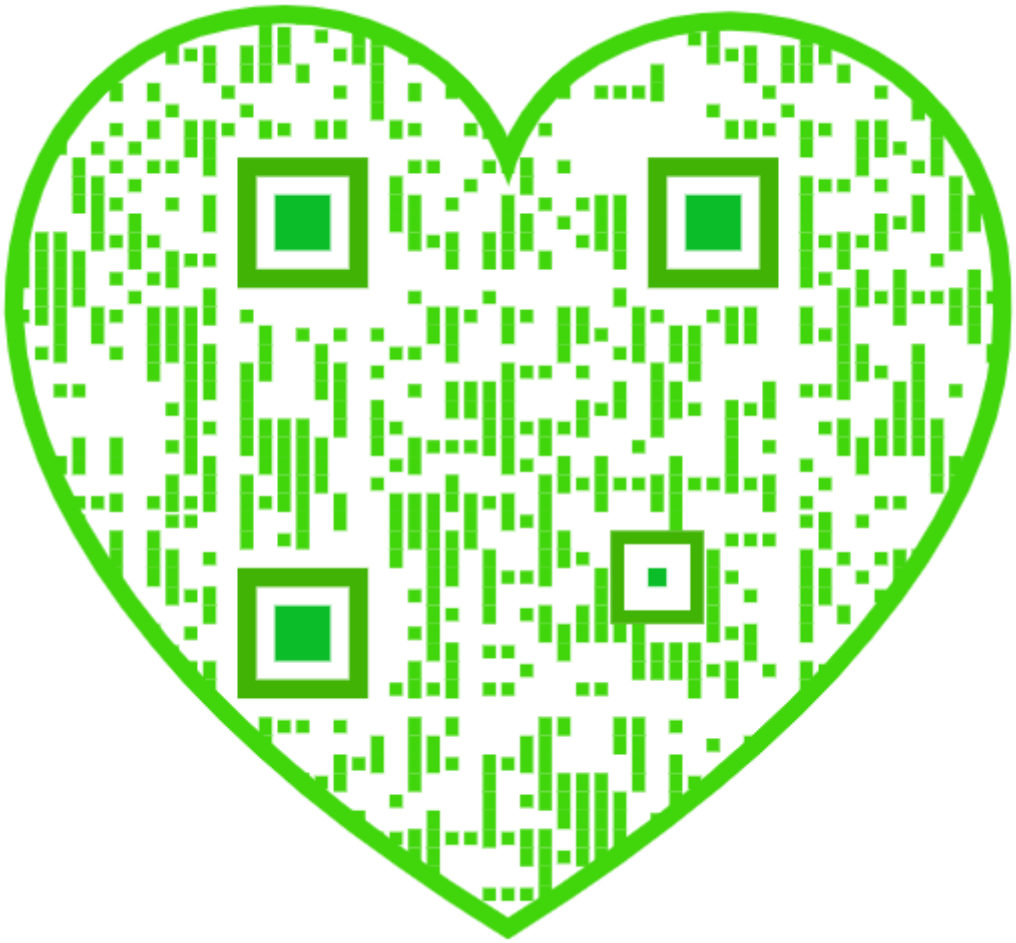


Longitudinal Section, Showing Interior Arrangements.

ELECTRICALLY LIGHTED, STEAM, LIGHTSHIP FOR SERVICE OFF CAPE HATTERAS. [See page 166].



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NEW YORK, SATURDAY, MARCH 17, 1900.

LIQUID AIR PROMOTION AGAIN.

We had occasion some months ago to refer to the unblushing attempts which were being made by so-called Liquid Air Companies to entice the public into the purchase of their stock. The storm of criticism which was leveled at these concerns by the technical press of the country caused the promoters to take to cover, with the welcome result that for the past few months the columns of the daily press have failed to be disfigured with the familiar liquid air advertisements.

It is evident, however, that "the snake was scotched, not killed," and that liquid air victims are as easily caught as liquid air profits are readily realized by the promoters. Not content with the Boston experience, the liquid air conspiracy has again taken the field, this time choosing New York city as the center of its operations. It is evident that the organizers of the latest "Company" are satisfied that the name of "Tripler" is one to conjure with in drawing the dollars from the pockets of the unsuspecting and all-too-little-informed investor. We have never hesitated to give Mr. Tripler every credit for his perseverance and mechanical ingenuity, and as the first gentleman to manufacture liquid air in commercial quantities in this country he deserves all praise. But when he lends his name to such a ridiculous and impossible statement of the uses to which liquid air may be put as appears in the latest advertisements of the company which bears his name, he is evidently tearing down with his left hand the reputation he has built up with his right.

We are compelled to take up this subject in our columns in order to answer the large number of correspondents who have written to this office asking for advice before they subscribe to the stock of a concern so full of alluring promises of profit. It is our conviction that liquid air has never made a dollar for its investors along the lines which are indicated in the advertisements of such companies as the one in question. We recommend any of our readers who are contemplating the purchase of liquid air stock to read carefully the contribution, on the accompanying page, from Mr. Hudson Maxim, who by the way, is quoted in the prospectus as one of the consulting engineers of the Tripler Liquid Air Company. Of the many claims made, there is one which is alone sufficient to stamp the whole scheme as being either of a very dubious character, or based upon a complete ignorance of the elementary laws of physics. In answer to the claim that "the use of liquid air in the generation of power on land and sea will reduce the cost to one-half of that now paid," Mr. Maxim shows that the "Teutonic" would have to carry for a seven-days' voyage more than enough liquid air to float the vessel itself, and that the cost for a single trip across the ocean would be a mere nominal sum of $174,560, this being the amount that it would cost to save about a half of the coal bill.

While it may be possible to find a commercial use for liquid air in the field of explosives along the lines indicated by Mr. Maxim, it would require a veritable boom in the sale of liquid-air cartridges to pay for the trip of one liquid-air-propelled "Teutonic." While it does not come within our province to advise correspondents who have written us whether they should or should not invest in liquid air companies, it is strictly within our province to warn them that many of the claims that are made by these companies are impossible and ridiculous.

THE CONSTRUCTION OF WARSHIPS AT GOVERNMENT NAVY YARDS.

A hearing on the question as to whether it is expedient that warships should be constructed at the Brooklyn Navy Yard is now being held before the House Committee on Naval Affairs. An influential committee of Brooklyn citizens, in which is included the former master machinist of the Brooklyn Navy Yard, is presenting a very strong case in favor of such construction, and there is no denying that the proposal thus put forward of the highest importance, touching as it does the whole question of the future growth and efficiency of our navy. Chief Naval Constructor Hichborn is favorable to the construction of naval vessels in the Government's yards, and in this he is earnestly seconded by Naval Constructor Bowles, who for many years past has been an earnest advocate of this policy. Mr. Bowles has had personal supervision of the building of some of our most important ships, and is particularly well qualified to judge of the somewhat complex question as to whether the Government yards can compete successfully with the well-equipped establishments at Philadelphia, Newport News, and San Francisco.

Before presenting the arguments in favor of the construction of vessels in the Government's yards, it is necessary to consider the rather disconcerning fact that the warships already constructed at the navy yards have cost considerable more than those which were built by private firms. If we take the two battleships, "Texas" and "Indiana," we find that the former which was constructed at the Norfolk navy yard, cost per ton of finished vessel, $819.97, whereas the "Indiana," built by the Cramps, if we include a claim for damages due to delay in supply of armor of $483,000, cost $724 per ton. The increased cost of the government-built vessel is explained by the abnormal conditions under which she was constructed, conditions which were so adverse as to render it surprising, not that the difference in cost was so great, but that it was not greater. In the first place, when, in 1889, the "Texas" was ordered built at Norfolk, that navy yard was practically without tools to do the work. Not a single vessel had been constructed there for twenty-five years, and at no time in its history had a ship been built there of iron or steel. The existing plant was merely such as was necessary for the construction of wooden vessels, and anyone who has visited a shipbuilding yard of the latter type will understand how serious a task confronted the naval constructor who was told to go ahead and build an intricate modern battleship in such a place, and with such a "plentiful lack" of facilities. The problem was not merely to build a ship, but to build the necessary tools as well—a complication which enormously increased the cost of the vessel.

In the second place, to these technical difficulties were added others of a political nature. On the day on which the construction of the "Texas" was begun, the naval constructor in charge received notice that eleven new foremen had been appointed on the work and it was found that not one of these political heelers had the slightest knowledge of the art of shipbuilding. If matters were unfavorable at Norfolk, they were even worse at the Brooklyn yard, where in 1888, the construction of the "Maine" was commenced; for it was a hotbed of political corruption, and was even more devoid than Norfolk of facilities for the construction of a modern warship. At both these yards the creation of a shipbuilding plant and the education of a large body of mechanics and foremen, coupled with the exasperating delays of a cumbersome system of red tape in the administration of the yards, was answerable for costly delays in the completion of the two ships, seven years intervening in the case of the "Maine," from the date of laying her keel to the date of her first commission. In view of these facts it is surprising that the government-built vessels should have come as close in cost as they did to the ships built in private and well-equipped yards which were entirely free from the encumbrances above noted.

It is the unanimous opinion of our corps of naval constructors that if the yards at Brooklyn, Norfolk, and Mare Island always had one or more warships upon the stocks, it would be possible to turn them out at the same, and probably at somewhat less cost, than that of the ships which are built by contract in private yards. Granting then that the ships could be turned out merely at the same cost, the question arises as to what advantages are to be gained by construction in the Government's yards? The following are the chief advantages among many:

Firstly.—At present the yards are occupied merely with repairs and refitting. As this work is intermittent, the force at the yards is constantly changing, and during the slack seasons more or less of the costly plant is lying idle. To prevent this and to retain the services of skilled operators there is an instinctive tendency to prolong repairs and tide over to a busier season. If there were always two or three ships on the stocks, the whole plant would be regularly employed. It would then be possible to maintain a thoroughly efficient and permanent organization at the yard with considerable resulting economy. At the Brooklyn yard, for instance, it is possible to employ at present 4,000 men in the construction department alone, and with comparatively slight addition to the plant it would be possible to employ 6,000 men.

Secondly.—The construction of warships at the yards would offer a valuable opportunity for training a corps of efficient inspectors for overseeing the construction of government vessels that are built by contract. There is a great demand for young men who are competent to oversee contract work, and they would easily pick up in the government yards the necessary experience.

Thirdly.—The high class of work done in the government yards would act favorably in competition with private work by setting a high standard of workmanship. While it is true that in some of the government-built vessels, as in those constructed by private contract, there have been defects of design, there has never been any complaint of faulty workmanship in the government-built vessels, all of which has proved to be of first-class and thoroughly durable character.

Fourthly.—While it is the belief of naval constructors that ships could be built at least as cheaply under existing conditions, they are satisfied that if badly needed reforms were made in the cumbersome and expensive methods of administration of the yards, it would be possible to effect a still further and considerable reduction in the cost per ton of navy-built ships. One of the most expensive, and certainly the most exasperating of the present red-tape methods, is the regulation which requires that bids shall be asked for the supply of any material, even in small quantities, that may be required at the navy yards. This results in frequent and very costly interruptions and delays in the work. It is a well-known fact that other things being equal the cost of a ship decreases in the exact ratio of the speed with which it can be built; in other words that it pays to "rush" the construction. The quickest built ship will be the cheapest.

Fifthly.—That navy yard construction of warships would have distinct advantages in economy over that carried on in private yards, is due to the fact that there would be no charges for depreciation or interest on the money invested, and that there would be no charges for administration, professional oversight, drafting and clerical work, the expenses of which are carried by other appropriations. Again, the navy yards do not have to reckon in profits, and it would not be necessary for them to add the large percentage which a constructor must include his total estimate of cost.

Sixthly.—By keeping in check any tendency for a combination among the constructors to place their bids at unreasonable figures, the continual turning out of government-built ships, at a reasonable cost per ton, would constitute an excellent safeguard of the interests of the nation.

Lastly, if the proposed measure is carried out, not merely with regard to the Brooklyn yard, but to the others mentioned, the total warship-building capacity would be doubled at a stroke—a consideration which of itself should be sufficient to induce Congress to take favorable action on the question. The enormous increase which is being made in the navies of the Continental powers, whose interests in the great commercial war of the day are bound to come into violent conflict with our own, should be a warning to us to stand ready to double, if necessary, our present rate of output of war vessels. At a comparatively slight expense it would be possible to add the navy yards at Brooklyn, Norfolk and Mare Island to our all too small list of available warship-building yards.

THE WORK OF THE DIVISON OF CHEMISTRY OF THE DEPARTMENT OF AGRICULTURE.

The work of the Division of Chemistry of the Department of Agriculture, which is under the direction of Dr. H. W. Wiley, is of great importance. The old quarters of the division have been found to be totally inadequate for its increasing labors, the old building was vacated and temporary quarters were found for the force, and much of the material and apparatus as was necessary for the work was transferred to Columbian University during the summer, and the laboratory work was even carried on after the regular laboratories had to be turned over to the students. In spite of the inadequate laboratory facilities for and delay in getting into the new building, a great deal of work was done during the fiscal year ending January 30, 1899. The association known as the Association of Official Agricultural Chemists has been in existence for about fifteen years and is composed primarily of chemists of agricultural experiment stations and agricultural colleges and it also admits to memberships all chemists employed in the control of food products by any State or municipality. The meetings of the association are held under the auspices of the Department of Agriculture and its work has thus assumed a degree of authority which may be regarded as official. The methods of analysis adopted by this association have been legalized by the courts in various parts of the country. The Division of Chemistry co-operates with the association in its valuable work. The reports of the association are issued as bulletins of the Division of Chemistry. The chief work of this kind which is accomplished during the past year was the revision of the entire methods of analyses of the association on all of its subjects, and this bulletin has been recognized as an authority in all parts of the world, and its contents has been reprinted in most of the languages of science. The effect of this organized effort on the part of agricultural chemists has been so pronounced as to induce other nations to follow the example which this country has set. It is to be hoped that Congress will see its way clear to acknowledge the association to be an official advisor of the government, or by recognizing it

in some way as by a vote for supplies. At present it has neither treasurer nor funds.

The study of soils under identical conditions, as illustrated and described in the SCIENTIFIC AMERICAN for December 3, 1898, has been carried on, and the results may be regarded as important. By far the greater part of the force of the division during the past fiscal year has been employed in the investigation of food products. The particular subject of food study which has been investigated is the preservation of meat by sterilization, otherwise known to commerce as "canned corn beef" and "canned roast beef." The scope of the investigation has been twofold. In the first place, the chemical composition and nutritive value of the meats have been determined. The results of this investigation has been to supply us with a definite idea of the food value of all the various products which have been examined carefully, and systematic research has been made for preservatives of all kinds which may have been used in or on these meats. Investigations have been also carried on in the culture of sugar beets and the production of beet sugar. Many thousands of samples have been received and careful analyses have been made, the results of which work were valuable in defining with greater accuracy the lines of the most successful beet culture in the country.

FACTS VERSUS CLAIMS FOR LIQUID AIR.

BY HUDSON MAXIM.

Liquid air is such a strange substance and so readily lends itself as a plaything for the imagination as well as for the hands, that many have been ready to believe the most absurd things concerning it. When it was first discovered that air could be liquefied, it was so very expensive as to preclude any serious considerations of its usefulness except as a scientific curiosity. But when Tripler showed that it could be produced by the gallon, and at low expense when compared with its cost by earlier methods, the question naturally arose concerning its commercial value.

So extraordinary are some of the claims which have been made for liquid air as a motive fluid, that the public eye is beginning to look askance at its mere mention in connection with any commercial application. This is unfortunate, both for the public and for the promoters.

Ignoring propositions for the production of perpetual motion by liquid air, which have been made and exploded, let us consider claims which are now being made by advertisers in the public press, from which I quote the following:

> "The use of liquid air in the generation of power on land and sea will reduce the cost to one-half of that now paid for steam power. This statement carries its own argument, and needs no elaboration."
>
> "In the production of motive power, liquid air has a wonderful future as a fuel saver. Liquid air, after a short exposure, loses most of its nitrogen (the chief obstacle to combustion), and the resultant oxygen used in connection with carbon (coal, coke, etc.) produces perfect smokeless combustion, avoiding the large percentage of loss now incurred in the use of fuel."

Liquid air is not a magic wand by which miracles may be wrought, and yet it is hard to see how, without the enlistment of the miraculous, such results can be accomplished.

Examining the first of these claims, let us compare liquid air with steam as a motive fluid, under like conditions, in a triple expansion marine engine. It is common for such an engine, with 250 pounds steam, to produce a horse power hour for every 1½ pounds of coal consumed. Now, suppose we were to substitute liquid air for the water. We should still require boilers for its evaporation, and to make it as economical as possible, let us assume that we heat it to the temperature of steam at 250 pounds pressure; in other words, to 406° F. It must be assumed that the air is to be expanded 4½ times, which is the average ratio of expansion in compound triple expansion engines at the present time. To determine the weight of any motive fluid required for 1-horse power hour, we have the following formula:

$$W = 183{\cdot}45\ T\left(1-\left(\frac{T''}{T'}\times\frac{T'}{T}\right)\right),$$

in which W is the work in foot-pounds, T is the initial temperature, T′ is the temperature after expanding to do work, and T″ is the temperature after expanding from the last temperature to atmospheric pressure. (Clarke's Manual of Rules, Tables, and Data, page 909.)

Solving the above formula, the result obtained is 78,607·6 foot-pounds, as the energy in 1 pound of air at 250·3 pounds pressure, and 406·2° F. temperature.

Therefore, 1-horse power hour would consume 1,980,000 ÷ 78,607·6 (foot-pounds in 1 pound of air) = 25·19 pounds of liquid air. It would take 0·7 of a pound of coal to evaporate this amount of air and superheat it to the temperature of saturated steam at 250·3 pounds pressure (406° F.). Hence, we should need nearly half as much coal per horse-power hour for the air as for water. By any means now known which could be employed on shipboard, the amount of heat which could be absorbed from the air and water and utilized would in practice be a negligible quantity. As air could not be re-condensed like water. we should be obliged to load up with enough liquid air to last the whole voyage without re-condensation.

The engines of the "Teutonic" develop about 20,000 horse power. This would require 242 tons of liquid air per hour, 5,829 tons per day, and 40,807 tons for a seven-days' voyage, considerably more than enough to float the vessel.

Some have made the claim that liquid air can be made as cheap as 2 cents per gallon. Let us assume, for argument sake, that such be the cost. This would be $4.28 per ton, and liquid air enough to take the "Teutonic" across the ocean would cost $174,560. In other words, it would cost this sum to save about half the coal bill.

This is, of course, without taking into account the additional horse power which would be required to carry the enormous cargo of liquid air necessary.

Referring to the second of the claims above quoted, it requires about 2⅔ pounds of oxygen to burn 1 pound of carbon. Air contains 22·92 per cent, or, roughly, 23 per cent of oxygen. A gallon of liquid air weighs about 9 351 pounds, 2·143 pounds of which is oxygen. If the nitrogen were separated so that all of the oxygen were saved, and if this could be done without expense, and if liquid air could be produced for 2 cents a gallon, then the oxygen would cost 0·9333 cents per pound, or $18.67 per ton. Now, let us assume that the coal costs $3 per ton. It would, therefore, cost $49·80 to save $3 worth of coal.

In regard to the value of liquid air for refrigerating purposes, of course much will depend upon the cost of its production. The latent heat of liquid air as calculated from data given by Sloane is 140 heat-units. As the specific heat of air is 0·2377, it would require 81·91 heat-units to raise 1 pound of air from its boiling point to the freezing point of water, or to the temperature of melting ice: 81·91 heat-units added to 140 heat-units = 221·91 heat-units. As the latent heat of ice is 144 heat-units, liquid air has a frigorific value above ice of 77·91 heat-units per pound. Yet, ice has many advantages above liquid air, not the least of which is its power to maintain adjacent bodies at the freezing point without actually freezing them.

For the preservation in transportation of substances which would not be injured by freezing, and by reduction to an exceedingly low temperature, liquid air might have an especial value in the saving of freight on ice, particularly when such substances contain a very high percentage of water. This is a proposition which I have never seen discussed, and it may, perhaps, be worthy of consideration. Let us take, for example, beef, which contains such a high percentage of water that we may consider its specific heat when frozen, as that of ice. The meat could be placed in a bath of liquid air before packing for shipment, and its temperature reduced to 313° below zero Fah. The specific heat of ice being 0·504, and the temperature of liquid air below zero Centigrade being 344·6° F., we have 344·6 × 0·504 = 174 heat-units. It would, therefore, require about 20 per cent more heat to raise the temperature of a pound of beef up to the melting point of ice than would be required for melting a pound of ice. Hence, the beef could be made to carry its own cold, as it were, and without the use of additional ice. This might be a means of saving considerable freight, as I have said. Yet, we must take into account that the rapidity with which heat is radiated or lost is as the square of the difference in temperature of bodies, and it would be necessary to carefully insulate articles so refrigerated for shipment.

With regard to the use of liquid air for internal combustion engines or explosion motors, it is estimated that in the Diesel motor, which is one of the most economical, both for the fuel and air consumed, it requires about 10 pounds of air to produce 1-horse power hour. This would require about 1 gallon of liquid air per horse-power hour; and if liquid air can be produced at 2 cents a gallon, then it would cost, in addition to the fuel, 2 cents per horse-power hour.

The contingent loss of liquid air by evaporation in transportation and handling, and while motors in which it is employed are standing idle, would certainly counterbalance any advantages which might exist from having the air in concentrated or liquid form.

Liquid air will be chiefly valuable as a source of oxygen for other purposes than the production of motive power.

If liquid air can be produced cheaply enough, even at, say, 5 cents per gallon, it may be destined to find its most useful application as an ingredient of blasting agents, especially for mining purposes.

I am aware of the many difficulties which would attend such use of it, yet I believe that if it can be produced at the above price most of the difficulties in the way of its practical application in blasting agents may be overcome. I have given this matter considerable thought, and have ascertained from calculations and experiments that explosives may be made from liquid oxygen and combustibles which will rank among the most powerful known to science. Liquid air, slightly enriched in oxygen by letting a portion of the nitrogen distill off, would produce, with a suitable combustible element, a high explosive comparable with dynamite.

It must be borne in mind that liquid air as a blasting agent, especially in mines, possesses some great advantages to offset its disadvantages. For instance, there would be no thawing out required in cold weather, with attendant inconvenience and danger, and the products of combustion would be smokeless. There would be no nitrous fumes, and the gases would be far less noxious than those produced by other explosives.

It has occurred to me that some of the difficulties which lie in the way of its practical application in the manufacture of explosives might be surmounted in the following manner:

In many mining districts very cheap water power, and in others very cheap coal may be obtained. If, by these means, liquid air can be produced at the prices I have suggested, then we might, perhaps, by a specially constructed centrifugal machine separate the oxygen from the nitrogen without much additional cost. We could then use the oxygen in making explosive cartridges, and these could be packed and immersed in a bath of liquid nitrogen. As the nitrogen is more volatile than the oxygen, there would be practically no loss of oxygen from the cartridges. In this way the cartridges could be shipped for a considerable distance, or kept for a considerable time before use; but, as the material could be put up at the mine, or in the mining district, it would not be necessary that many hours intervene between its production and its use. In charging holes, they could first be chilled by a jet of liquid nitrogen, and their temperature so lowered that the oxygen would not be very rapidly driven off for some time after loading. To further protect the cartridges, they could be covered with a combustible non-conductor of heat, which would form part of the explosive.

The explosive would be so quick in its action that the holes would need only to be tamped by simply filling them with water, or by pouring sand into them, instead of ramming them in the usual way, and, in many cases, no tamping at all would be required.

To prevent tamping being blown out by the evaporating oxygen, a small and very thin copper tube could be inserted into each hole when loading, which would serve both to vent the hole and to conduct electricity to an exploder to fire the charge.

In order to allow for some evaporation, we might use 3 pounds of oxygen to a pound of carbonaceous matter in producing explosives. Three-quarters of a pound of oxygen, and a quarter of a pound of carbonaceous matter would, therefore, produce 1 pound of explosive. Oxygen, at 20 cents per gallon, would cost about 2 cents per pound. The carbonaceous matter would not cost more than half a cent per pound. We would need, therefore, 1½ cents worth of oxygen, and ½ cent worth of combustible matter. Hence, our explosive would cost 2 cents per pound. Now, if we double this cost to make allowance for incidentals, labor and interest on capital, and add another cent per pound for loss in weight by evaporation, we would still have a powerful explosive at a cost of 5 cents per pound, and one which would have some obvious advantages above dynamite, at less than half its cost.

At any rate, if liquid air can be made at a sufficiently low cost the question of its application in the manufacture of explosives for mining purposes is worthy of consideration.

A BILLION DOLLAR COUNTRY.

Every year's developments seem to justify the assertion that this is a "Billion Dollar Country." The year 1899 brought our foreign commerce for the first time past the $2,000,000,000 line, and the month of February, 1900, shows our money in circulation for the first time as more than $2,000,000,000. Thus, by a peculiar coincidence, the announcement of $2,000,000,000 of foreign commerce and the $2,000,000,000 of money in circulation are made within a single month, the totals indicating that the $2,000,000,000 line had been crossed in our commerce for 1899, the figures being official, having been compiled by the Treasury Bureau Statistics, and the Treasury Bureau of Loans and Currency. The total foreign commerce for the year 1899 was $2,074,345,242, while the total money in circulation on February 1 was $2,003,149,355. The use of figures carried out to ten places with which to show the business conditions of the country is indeed becoming surprisingly frequent. For example, the total resources of the national banks is $4,475,343,924. The latest report of the Comptroller of the Currency shows that the deposit in savings banks amount to $2,230,366,954. The total resources of all banks in the United States are given as $5,196,177,381. The amount of money for each individual is greater to-day than ever before. The actuary's estimate that the population shows that on February 1, 1900, it amounted to 77,116,000, the money in circulation being $2,003,149,355, the circulation per capita is $25.98. This gives a larger per capita than in any previous month in the history of the country.

THE ASIATIC PLAGUE AT HONOLULU.

The appearance of the Asiatic plague in the Sandwich Islands, where, at latest accounts it was not only spreading throughout the Archipelago but increasing in virulency, is a sinister and deplorable fact. While the source of the infection is not certainly known, the general belief is entertained that it was introduced into Honolulu by the Japanese steamer "Nippon Maru" which touched at that port sometime in September after a voyage in which several of her steerage passengers died of the disease. Though every precaution was taken by the quarantine authorities of Honolulu to prevent the contact with either freight or passengers of the steamer, it would appear that the infection was communicated in some way or else was conveyed in shipments of goods from Japan or China, to the islands where they are largely consumed.

The possibility of contagion has been admitted by the Honolulu authorities and most careful preparations were made for coping with the emergency as soon as signs appeared, but months passed without any alarming indications, and, it is possible, vigilance was somewhat neglected. On December 12, the first case appeared. A Chinaman of the better class died with mysterious symptoms. He had been attended by a native practitioner who pronounced the disease as the plague. Another Chinaman died on the same day of the same complaint. Autopsies proved the suspicions to be correct, and then began the stringent and drastic attempts to slay the threatened catastrophe. The bodies of both victims with all their surroundings were cremated. Every person with whom the patients had come in contact were rigidly isolated. The houses were all fumigated and surrounded with guards, and it was hoped that these means would be effective in confining the contagion to the quarters, where it first appeared. No attempt was made to conceal the real facts from the public, on the contrary the citizens were informed of every measure taken by the health authorities, and exhorted to co-operate in all ways. The town was thoroughly cleansed and a free distribution of disinfectants was made. The plague rapidly manifested itself, and by December 14, six fatal cases had occurred, all among the laboring classes. The infected region of the city was quarantined, twenty blocks in all. The houses where the plague had appeared were burned and the authorities assumed the task of feeding those whose income had been cut off by the quarantine. On December 20, 2,500 were being fed and housed.

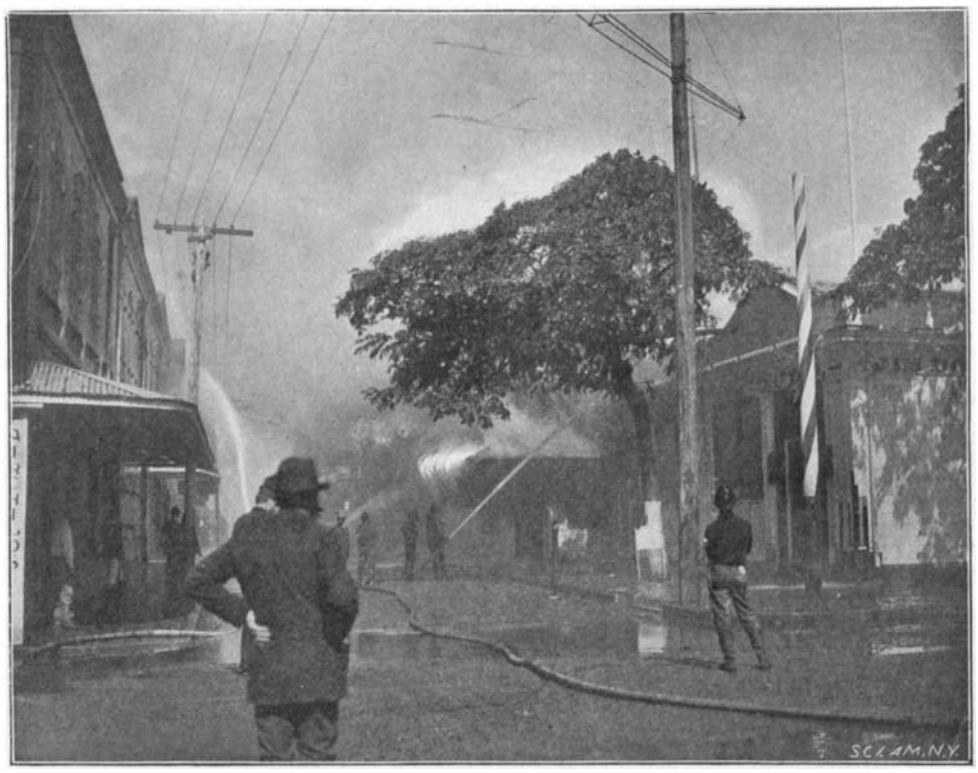
The plague at this point seemed to be stayed, for up to December 30 only nine cases were reported, of which eight resulted fatally. After this there was a rapid increase. For the week ending January 6 a total of twenty-one cases had been treated, of which ten had died. For the next three weeks there were twenty-nine cases and twenty-six deaths.

On January 21, during the ignition of a plague-stricken domicile, the flames, driven by a high wind soon got beyond control, and before long the whole of the Asiatic quarter was in flames. No attempt was made to save the district, but all the firemen's efforts were concentrated in preventing the destruction of the whole city. In this they were successful, though not until eighteen entire blocks of Chinese houses and shops were consumed. The confusion and frantic alarm of the Asiatic element was beyond description. Over 5,000 were rendered homeless and became a public charge.

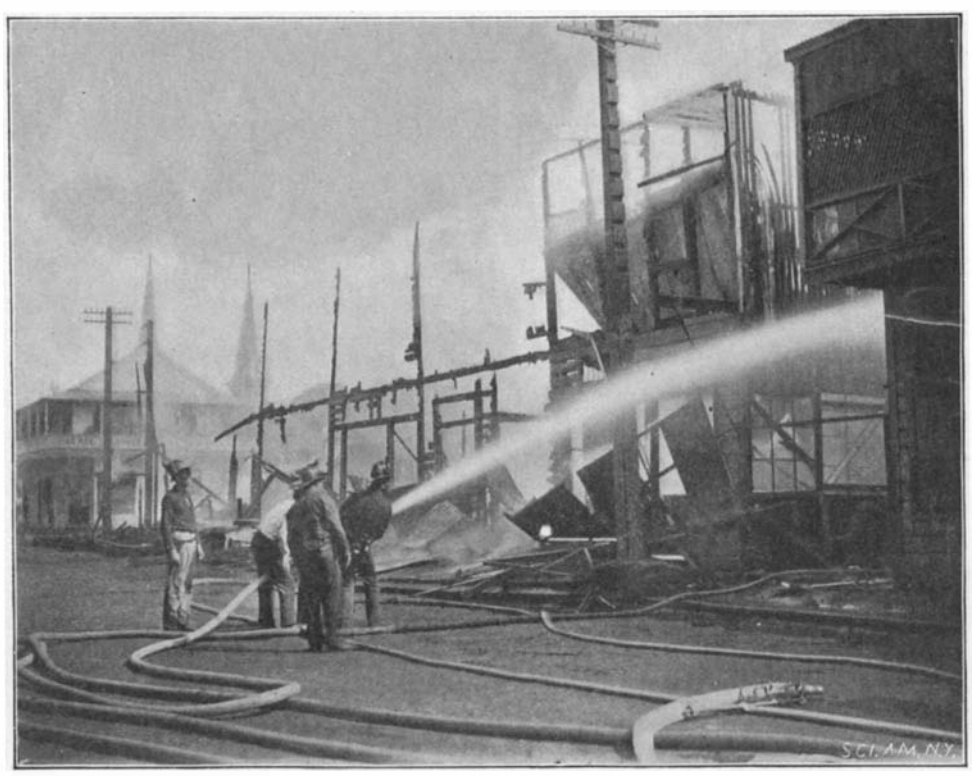
Honolulu had, in the meantime, been quarantined against by all the neighboring islands, and the rest of the world besides, and was completely isolated. The internal administration of the plague-stricken community was directed toward keeping the plague in check. An appropriation of several hundred thousand dollars to pay for property destroyed and for sanitary purposes was soon expended. The loss by the great fire was fully a million and the end was not in sight, but the heroism of the citizens did not shrink and no sacrifice that would prevent the infection from becoming seated in the islands with the attendant losses of life and business was too great. A system of local inspection was inaugurated. House to house visitation was begun and every one, regardless of age, sex or condition was compelled to submit to almost daily examination. The responsibility fell upon the 7,000 whites of a community numbering above 40,000 souls.

After the great fire the cessation of deaths were very marked. It was not thought that even so heroic a remedy would completely extirpate the plague. The most expected was to get the disease under control, and this seemed to have been the case, for up to February 20 there were only two deaths. On that date, however, three deaths occurred, the first in thirteen days. The plague has, in the meantime, appeared in the island of Maui, and at Hilo. At Kahului a case of the disease has been found, and there is but little chance of the other islands escaping. In but one instance, in Honolulu, has a white person been the victim. A lady of superior position acquired the plague, it was surmised, from rats. All the others were of Asiatic birth or persons who ordinarily associated with them.

In tracing the infection the evidence all points to a common source—the consumption of goods imported from the Orient.



HOTEL STREET, SHOWING THE DESTRUCTION BY FIRE OF PLAGUE-INFESTED DISTRICT.



MARION STREET, HONOLULU, SHOWING THE BURNING OF THE PLAGUE-INFESTED BUILDINGS.

THERE is every probability that the Paris Exposition will not be ready for public inauguration on Easter Sunday, April 15. Many of the buildings will be incomplete, and the exhibition will be only during the daytime for some time after the official opening. It is thought by May 1, that the exhibition will be in a fairly satisfactory state.

Congresses at Paris.

Mention has already been made of many of the congresses to be held in connection with the forthcoming International Exposition at Paris, says Nature. The following list, prepared by the committee of the Paris International Assembly, the secretaries of which are Prof. Patrick Geddes and Mr. T. R. Marr, shows the date of some of the more important congresses announced in science and education:—Pure Science: Ornithology, June 26 30; meteorology, July 23-28: physics, August 6 11; mathematics, August 6-11; geology, August 16-28; electricity, August 18 25; anthropology and archæology, August 26-25; psychology, August 22-25; ethnography, August 26-September 1; chemistry, September 20-29; botany, October 1-6. Applied Science and Associated Industry: Horticulture, May 25-27; forestry, June 4-7; mines and metallurgy, June 18-23; vine cultivation, June 20-23; insurance, June 25 30; actuaries, June 25-30; agriculture, July 1-7; testing of materials, July 9-16; steam engines and machinery, July 16-18; applied mechanics, July 19-25; architecture and naval construction, July 19-21; photography, July 23-38; applied chemistry, July 23-31; navigation. July 30-August 4; pharmacy, August 8; economic and commercial geography, August 23-31; tramways, September 10-12; fruit culture, September 13-14; railroads, September 20-29. Medicine and Hygiene: Homœopathy, July 18-21; professional medicine, July 23-28; medicine, August 2-9; dermatology, August 2-9; dentistry, August 8-14; hygiene, August 10-17; hypnotism, August 12-15. Education: Modern language teaching, July 24-29; higher education July 30-August 3; teaching of social science, July 30-August 5; primary education, August 2-5; secondary education, August 2-5; technical, industrial education, August 6-11; educational press, August 9-11; bibliography, August 16-18; teaching of drawing, August 29-September 1; popular education, September 10-13; agricultural instruction, September 14 16.

The Copyright Business of the United States.

The last report of the Librarian of Congress gives in tabular form the copyright business for the fiscal year of 1898-99. The total fees received for domestic entries was $36,507.50; foreign entries $7,953; the fees for certificates amounted to $12,577.50, and the amount received for the recording of assignments was $1,218, This together with $11 for searches made a total of $58,567, and the total number of entries of titles amounted to $80,968. In the calendar year of 1898, the total number of deposits received including duplicates, amounted to 115,610. The total communications received during the fiscal year was 67,666, and the total communications sent out including letters written amounted to 98,729. The number of copyright deposits from July 1, 1898, to June 30, 1899, amounted to 59,217, and as two copies of each were received it reached 118,434, of this number 59,217 only 5,834 were of books proper. There were 4,196 articles entered under the term "book" under the copyright law including circulars, leaflets, charts, etc. There were 5,185 newspaper and magazine contributions, 517 dramatic compositions and 9,777 numbers of periodicals, 19,973 musical compositions, 1,478 maps, 3,505 engravings and prints, 1050 chromos and lithographs and 7,695 photographs. The weekly catalogue, authorized by Congress March 3, 1891, has been kept up and the weekly numbers for the fiscal year 1898-99 amount to 3,693 printed pages of octavo size. The registrar of copyrights is Thorvald Solberg, Esq.

Kansas' Corn Crop.

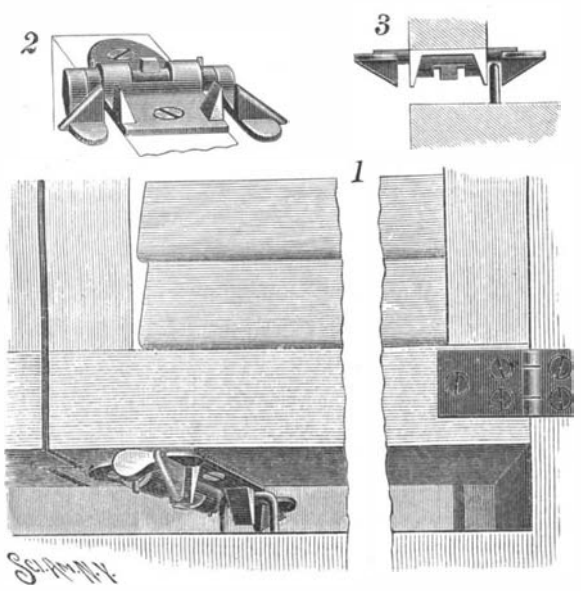
We understand that in the ten-year period just closed Kansas has raised 1,441,890,410 bushels of corn, of a value on the farms where raised amounting to $364,633,448. We have been favored by the Secretary of the State Board of Agriculture of Kansas, Mr. F. D. Coburn, with a nicely framed photograph of an enormous ear of Kansas White Dent corn.

A SIMPLE SHUTTER-FASTENER.

The shutter-fastener which we illustrate herewith is a simple and ingenious device for locking a blind to the window-sill or to the outer wall of a building. The fastening means operate entirely by gravity, no spring being included in the construction. The patent on the fastener is the property of Mr. Ubert K. Pettingill, of 22 School street, Boston, Mass.

Fig. 1 shows part of a blind and window-sill, with the fastener in locking position. Fig. 2 is an inverted bottom view of the device. Fig. 3 represents a section of the blind and sill, with the fastener in elevation.

The fastener is attached to the under surface of the



PETTINGILL'S SHUTTER-FASTENER.

blind and is composed of only two parts—a plate held in position by screws, and a rod or spindle rotating in a socket in the plate.

The plate is provided at its sides with stops, one of which is designed to engage the staple on the window-sill, and the other of which is designed to engage a corresponding staple or fixture on the wall of the building, both stops serving the purpose of limiting the swinging movement of the blind.

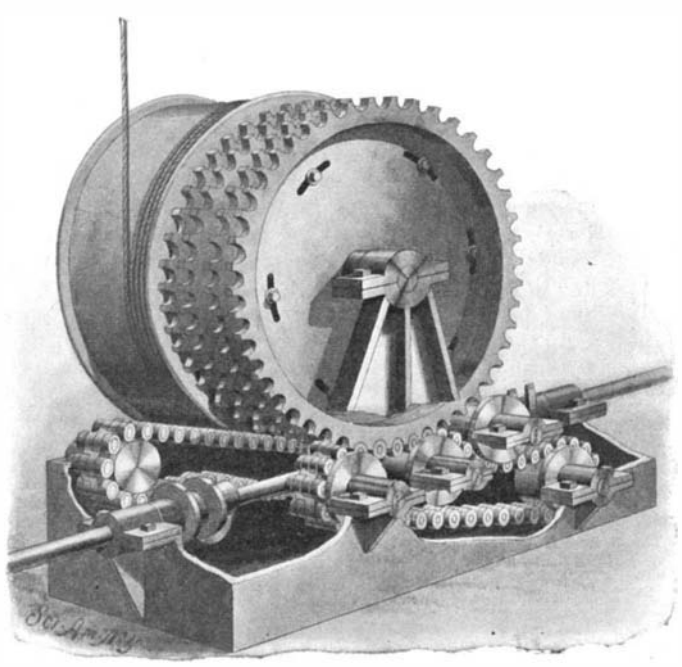
The rotating rod or spindle is provided at its ends with arms carrying on their under surfaces lugs, beveled so as to ride over the staples. The arms and lugs are heavy enough to swing the spindle downwardly, to permit their engagement with the staple.

As the blind is swung inwardly, the lug on the inner arm strikes the staple on the window-sill, rises as it rides over the top of the staple, and falls by its own weight and that of its arm to the position shown in Figs. 1 and 3. The inner stop at the same time engages the staple and arrests the blind. The blind is now locked by the stop on one side and the lug on the other. To release the shutter it is necessary merely to lift the arm and turn the spindle upwardly. To limit the drop of the spindle, the socket in the plate is recessed (Fig. 2) to receive a stop on the spindle, of smaller width than the diameter of the recess.

The device can be cheaply made, consisting as it does of but two pieces of cast metal. From a working model loaned to us by the patentee, the device seems to be very efficient in its operation.

A WORM AND CHAIN DRIVING-GEAR FOR ELEVATORS.

To provide a worm and chain driving-gear for elevators and hoisting machinery which will avoid the objections raised against devices of a similar nature is the purpose of an invention for which a patent has been granted to Mr. Daniel Corcoran, of Yonkers, N. Y.



A NEW DRIVING-GEAR FOR HOISTING-DRUMS.

Mr. Corcoran's gear, as our illustration shows, comprises a right worm and a left worm secured to a common shaft. Each worm is engaged by a chain passing about two flanged guide-pulleys and meshing with toothed disks secured to the hoisting-drum. The links of these two chains are of Z-shape, being composed of two sections offset from each other and pivoted together. The pivot-pins carry rollers which are the portions of the chains which enter the grooves formed by the threads of the worms. The chains are firmly held up against the worms by thrust-disks bearing against the outer edges of the chains and turning on their pivots.

Power being applied to the worm-shaft in any suitable manner, the worms will engage the link-rollers, causing the chains to travel over their guide-pulleys and to rotate the toothed disks to which the hoisting-drum is secured. The chains, it will be seen, are so driven by the oppositely threaded worms and conducted by the guide-pulleys that both are caused to rotate the drum in the same direction. The lower guide-pulley of each chain dips within an oil-box constituting the base of the gear. By this means the chains are thoroughly lubricated.

Owing to the use of right and left worms, the end thrust is taken up by the chains and thereby neutralized. The chains, moreover, are so arranged that they lie on opposite sides of the worm-shaft.

It is desirable that one of the toothed disks be adjustable so as to regulate the strain upon the two chains. For this purpose the inventor has provided segmental slots in one of the disks, which disk is not rigidly secured to the drum-shaft, but is held in place by bolts passing through the slots and fastened to the adjacent disk.

AN AMATEUR'S CAMERA FOR PHOTOGRAPHING IN NATURAL COLORS.

The camera illustrated herewith for photographing in natural colors was devised by M. L. Ducos du Hauron for the use of amateur photographers, and it is said to give very satisfactory results.

The principle upon which it operates is well known, and consists simply of making three negatives through three colored screens, blue, green and red.

To accomplish this, the box, *F*, of the camera is divided into three compartments, one above the other, and each having a separate lens. The box, *A*, containing the three mirrors, M^1, M^2 and M^3, set at an angle of 45°, is slipped into a groove, *L*, in front of the lenses. The mirrors face the lenses, and the image is projected upon them by a fourth mirror, *M*, also set at 45°, but in the inverse direction, in the top of the box. The first two mirrors, M^1 and M^2, are transparent, and reflect only a part of the luminous rays, allowing the rest to pass through and be reflected by the silvered mirror, M^3.

By means of this arrangement, each lens, although receiving only part of the luminous rays emanating from the object being photographed, throws an exact image of it on the sensitive plate at the back. A frame, *E*, slides into the groove, *H*, in front of the plate-holder containing the sensitive plate. In this frame are the three colored glasses, the blue at the top, the green in the middle, and the red at the bottom. The plate-holder shown at the top of the illustration is of the ordinary kind, and made to hold a single plate of the proper size to receive all three images. The use of isochromatic plates is indispensable for this kind of photography and as these plates are very sensitive, it is necessary to take every precaution and not expose them to the red light during development any more than is absolutely necessary.

It will be noticed that the blue screen—the one through which the most actinic light passes—is the one to receive the first reflection of light coming from the object, and consequently the most intense reflection. The red glass, on the contrary, receives only the light that has not passed through the others. As the result of this, the upper image is always too brilliant; but the inventor has remedied this by placing a horizontal yellow screen with a small hole in the center between the first mirror which reflects the object and the first transparent glass. By this arrangement, the greater part of the blue rays are stopped, as they can only pass through the small hole, while the other rays are in no way hindered by the yellow screen, and are reflected by the other mirrors through their respective lenses.

In order to prevent any halation it is well to coat the back of the plates with a special "backing." There are several formulas for this, but, in order to have it easy to apply, M. Ducos du Hauron has invented a slightly sticky composition having all the properties of an efficacious "backing," and which can be spread on sheets of paper. These are cut the proper size and stuck on the back of the plate before placing it in the camera. The "backing" can be removed from the plate before development by taking one corner of the sheet and carefully pulling it off, after which it can be used again on another plate if desired.

The focusing is done very simply, in much the same way as with an ordinary camera. Two of the mirrors are covered, so that but one image is thrown on the ground glass in order to avoid confusion. The ground glass frame is slipped in the plate-holder groove in the regular manner, and the tri-color frame removed.

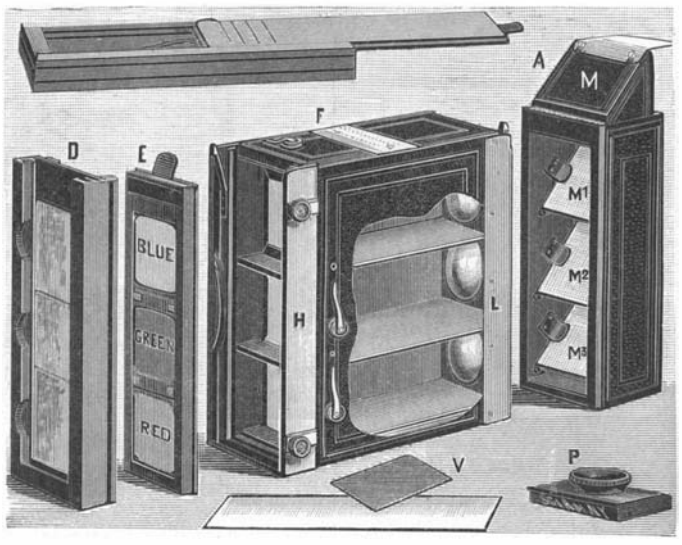
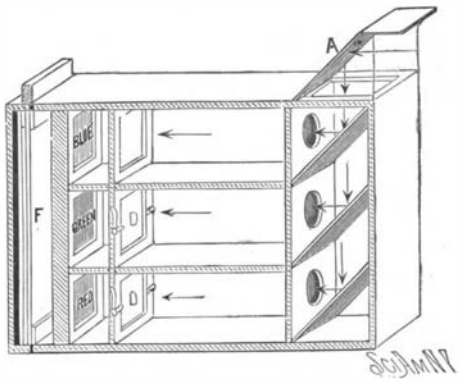


Fig. 1.—M. DUCOS DU HAURON'S APPARATUS FOR PHOTOGRAPHY IN COLORS.

Then the operator can focus as with an ordinary camera, and move the frame, *H*, backward or forward a short distance by means of a rack and pinion.

It will be seen from the above description that the negative can be made as easily as with an ordinary camera, and by any amateur. The positive is obtained still more easily by contact, and any good lantern slide or stereoscopic chloride plates may be used. It is always well, however, to back them while making the exposure, in order to prevent the slightest halation.

Upon developing the positive, three transparencies on one plate will be obtained, in which the clear portions of each correspond to the opaque parts of its respective negative. If the plate thus obtained be slipped into the open frame, *D*, and the latter be placed in the groove which held the plate-holder when making the negative, i. e., the groove just behind the colored screens, each image will be properly colored proportionally to the quantity of light which acted upon the sensitized plate.



SECTION OF THE CAMERA.

To view the image obtained, the receiving mirror, *M*, is removed and replaced by a small eyeglass, *P*, and the camera is held near a window with its back at an angle of about 45° with the horizon, as is shown in Fig. 2. A ground glass, *V*, slipped in a groove in front

Fig. 2.—USING THE CAMERA FOR VIEWING THE POSITIVE IN COLORS.

of the positive, disperses the light and renders it uniform for all three transparencies.

The light passes through the camera in the opposite direction to what it did at first, and shows to the eye a single image, composed of the three positives superimposed upon one another, and each furnishing its own color. The result is a picture in natural colors.

To produce a perfectly clear, distinct image, it is necessary to have the three images register with one another exactly, and the inventor has provided for regulating this, if, for any reason, the coincidence should not be exact. For this purpose he has pivoted, just in front of the red and green glasses, two movable screens of plain glass, operated by the little lever arms, shown in the illustration. By moving the screens slightly, two of the images will be refracted and made to coincide exactly with the other one.

The importance of clearness and sharpness in each separate image in order to produce a good picture cannot be too greatly emphasized. This trouble is avoided in this camera to a great extent, since the picture is viewed through the same optical system that was used in obtaining the negative.

A trial of one of these cameras proved its excellent qualities.

We are indebted to La Nature for the foregoing description and illustrations.

STEAM ELECTRIC LIGHTSHIP FOR CAPE HATTERAS.

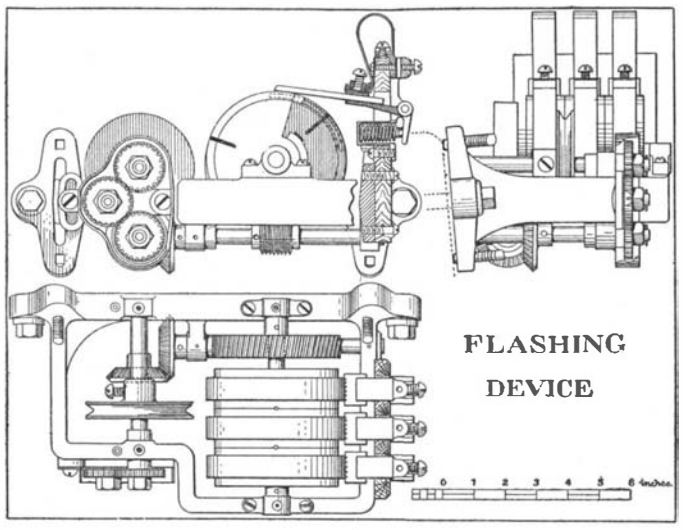
Among the vessels which are engaged in the Atlantic coasting trade and all that have occasion to pass by the coast line of North Carolina, there is a wholesome dread of the dangers of navigation off Cape Hatteras. Scattered throughout the oceans and seas of the world are to be found several localities whose fatal list of casualities to steam and sailing vessels, has caused them to be regarded as the graveyards of the deep. One of the most notorious of these is that region of dangerous shoals and storms which lies off the wedge of the coast line which forms the easternmost point of North Carolina. Cape Hatteras reaches further out into the Atlantic than any other point of land south of the capes of the Delaware, and the Gulf stream in its eastern and western variations is liable to flow at times within twenty miles of Cape Hatteras, with the result that coasting vessels and others whose course brings them near the cape, are crowded. in their endeavor to avoid the northeastern current, close to the shore. The set of the tides up and down the coast, the existence of shoals, and the constant opposition of tide and wind, produce a strong tidal race off the cape. At the same time the difference of temperature between the hot winds of the Gulf and the cooler breezes along the shore and from off the land, result in atmospheric disturbances of great severity, and there is no point of the Atlantic coast where storms are so frequent and dangerous. For the protection of shipping there is a lighthouse about a mile and a quarter from the outermost point of the cape, whose focal plane is 190 feet above the level of the sea. A few miles off the shore are the justly dreaded Diamond Shoals, on which furtile attempts have been made to erect a lighthouse. Something over a decade ago the contract was let to a large and experienced contracting firm in this city for the sinking of a huge caisson into the sandy bed of the shore upon which to carry the proposed structure. The caisson, however, was wrecked and the failure seems to have discouraged any further effort. It would seem as though the only practicable way to protect shipping is to moor a lightship above the shoals and this has been attempted. The last vessel to be placed there was recently torn from its moorings during a heavy gale, and it became evident that a ship of special design was necessary to meet the exceedingly trying local conditions. Such a vessel has been designed and is now nearing completion at the yards of the Fore River Engine Company, of Massachusetts. She will be steam-propelled and electric-lighted, and when completed she will be one of the first, if not the only one, of her kind ever launched. The government contract calls for a vessel 112 feet between perpendiculars, with a molded beam of 28 feet 6 inches, and a depth of 14 feet 10½ inches measured from the main deck beams to the top of the keel amidships.

The vessel will have three decks, the main and spar decks running full length of the ship, while the lower deck is broken by the forward coal bunker and the after bulkhead of the engine room. The hull will be divided by watertight steel bulkheads into five compartments, and the quarters and storerooms are so arranged as to meet all requirements of safety and comfort. The dynamos and engines for the electric light plant will be located on the main deck, as shown, and within the engine and boiler casing. The accommodations for the crew are forward on the main deck. There will be two hollow steel masts, through which the wiring for the masthead flashlights is to run. These lights, three in number on each mast, are to be adapted for electricity or for oil lamps. The cluster masthead lights will be 59 feet above the waterline, the measurement being taken from the 12-foot waterline to the focus of the lamps.

The electric plant will be driven by two non-condensing, double-cylinder engines, running under a steam pressure of 80 pounds to the square inch. The vessel will be lighted by eighty 16-candle power 100-volt lamps, which will be placed where necessary throughout the ship. The masthead cluster will consist of six 100-candle power 100-volt lamps, and these lights will be controlled by an automatic flashing device, of which we present three views. It is driven by means of a belt from the dynamo shaft, and a worm and worm wheel which serve to give the proper rotary speed to a circuit-breaker. The lightship will be propelled by an inverted, surface-condensing, single-cylinder engine of 250 indicated horse power, with a cylinder 23 inches in diameter by 22-inch stroke, driving a cast iron propeller 7 feet 3 inches in diameter. Steam will be supplied by two straight, cylindrical, tubular boilers, 9 feet by 16 feet 7½ inches, with a working pressure of 100 pounds to the square inch. The deck fittings of the vessel, as shown in the two engravings, are flush, with a view to presenting as little surface as possible to the action of wind and water.

When No. 72 is on her station off the treacherous Hatteras shoals her mooring tackle will consist of a heavy mushroom anchor, shackled to a chain which leads through the main hawser hole in the stem of the ship to a steam windlass. In addition to this mooring tackle, the vessel will have a 2,000-pound harbor anchor, a kedge weighing 340 pounds and 120 fathoms of 1⅛-inch stud-link chain, with a breaking strength of 79,100 pounds. Amidships, on either beam, will be swung two whale boats of about 26 feet length and 6 feet beam.

The spar deck is protected by a gradually rising steel waist, which starts flush a little forward of abreast the foremast, flaring somewhat at the knightheads until at the stem proper it has a depth of 5 feet. In addition to the steam whistle, the lightship is provided with a steam siren which is fitted just forward of the smokestack, as shown in the drawing, for use in thick and foggy weather.



FLASHING DEVICE FOR THE NEW CAPE HATTERAS LIGHTSHIP.

A Vessel for Antarctic Exploration.

A wooden vessel, 172 feet long by 33 feet beam and 16 feet draught, is about to be built by a Dundee concern for Antarctic exploration purposes for the Expedition Committee of which Sir Clements Markham, president of the Royal Geographical Society, is chairman. The vessel's displacement will be 1,570 tons, and the hull is to be constructed of oak, with an outer sheathing of greenheart, says The Engineer. It will be specially strengthened to withstand ice pressure, and a magnetic observatory is to be fitted up on the upper deck, amidships, to obviate any magnetic interference. The deck is to be lined with asbestos, and the machinery will be placed aft in order that the observatory may be free from any undue magnetic influence. The vessel will be completed by March, 1901, and the cost, exclusive of machinery, will be $168,500.

Strength of Alloys of Nickel.

According to Rudeloff, the strength of alloys of nickel with iron containing little or no carbon increases with each rise in nickel up to 8 per cent, while the ductility decreases up to 16 per cent; beyond this point, and up to 60 per cent, the increase of nickel causes an increase both in ductility and strength. The effect of nickel on the elastic limit of steel increases as the carbon increases, says The Engineer. In 0·20 carbon steel, the gain on elastic limit due to 1 per cent of nickel is 5,714 pounds; while in 0·50 carbon steel, the gain on elastic limit, due to 1 per cent of nickel, is 10,570 pounds. These figures are abstracted from a table of figures given by the Bethlehem Steel Company on oil-tempered annealed forgings.

Acetylene Notes.

ACETYLENE SIGNALS.—English military men have passed acetylene-gas signals from Corfe Castle to Bournemouth West Cliff, a distance of twelve miles, the message being clear to the naked eye, says The Acetylene Gas Light Journal.

VELOCITY OF DETONATION OF ACETYLENE.—Berthelot and Le Chatelier. (Comptes Rendus, 129, pp. 427–434, August 28, 1899.) The acetylene was exploded in horizontal glass tubes about 1 millimeter long and of 2 to 6 millimeters in diameter, and was operated with at various pressures between 5 and 30 kilogrammes per square centimeter. The velocity was registered by a falling photographic apparatus, released at the moment of detonation. The image of the horizontally moving flame in the tube, combined with this vertical movement, gave a curve on the photograph, from which, at any point, the velocity could be found. In some cases the trace was almost a straight line, but in others it showed a velocity increasing to a maximum. The results indicate that the velocity depends upon the initial pressure of the gas, from about 1,000 millimeters per second at 5 kilogrammes per square centimeter to 1,600 at 30. The differences in character between the case of acetylene and the explosion of, say, oxygen and hydrogen, is pointed out. In their case bodies are formed which dissociate at temperatures reached in the explosion, so that the action is not so uncontrolled as when the products are those of decomposition only.—Science Abstracts.

THE PURIFICATION OF ACETYLENE.—Dr. F. B. Ahrens, of Breslau, has lately investigated the causes which occasionally produce much heating and a large yield of free or combined chlorine when chloride of lime is adopted as an acetylene purifier, says Feilden's Magazine. He finds that chloride of lime alone does not heat in the gas; the rise in temperature is due to the presence of sawdust and water, which are employed to increase the bulk of the material or its power of absorbing impurities. He concludes that chloride of lime must either be mixed with a large quantity of sawdust or with a very small quantity of water; but it is preferable to omit the sawdust entirely, using in its place kieselguhr (infusorial earth), powdered coke, powdered brick, or chromate of lead, as recommended by Wolff. Incidentally he explains the complaints made by Vertess about the Veszprim acetylene, for he says the gas was treated with chloride of lime (presumably without a second vessel, charged with slaked lime only), and periodically smelt so strongly of chlorine, and annoyed the consumers so much, that the whole process of purification had to be temporararily abandoned. Yet another investigation of acetylene purifying processes has been carried out by Dr. G. Benz, of Heilbronn. He says that Frank's and Ullmann's materials are very similar in their action, and are both satisfactory, especially in dealing with the phosphoreted hydrogen. Chloride of lime, however, is cheaper and simpler, but it must be used with a second vessel, containing slake lime alone. In order to prevent overheating, he agrees with Ahrens that sawdust must not be added, powdered slag or coke being better.

PHOTOMETRY OF ACETYLENE.—An account of the photometry of acetylene is given by L. W. Hartman (Phys. Rev. 9, pp. 176–188, September, 1899). It treats of the photometric study of mixtures of acetylene and hydrogen burned in air. The results are exhibited by means of curves. From these it appears that the acetylene-hydrogen flame is richer in the short wave lengths than the flame burning acetylene alone used as a secondary standard. Moreover, the color properties of the flame appear to be independent of the amount of hydrogen in the mixture. Upon going to the limit this statement would not hold true. Lava tip and brass tip burners were used. In the case of the brass tip it is shown by curves giving the relation between percentage of acetylene and candle-power, that the candle power reaches a maximum and then falls away with increasing percentage of acetylene. This is due to the incomplete combustion of the gas after a given percentage of acetylene in the mixture has been reached. In the case of the lava tip, the flame with low percentages of acetylene appears very like the flame of burning hydrogen; at first it slowly increases in candle power with increasing percentage of acetylene, and does not reach the stage of incomplete combustion.—Science Abstracts.

California's Big Trees Protected.

On March 6 the Senate passed a House joint resolution directing the Secretary of the Interior to open negotiations for the requisition of land in Calaveras and Tuolumne Counties, Cal., containing the mammoth tree grove and the South Park grove of the big trees. This will head off a plan for converting the trees into lumber, an option having been obtained on them by a Western lumber dealer. We have already referred on several occasions to the importance of keeping these remarkable groves of trees intact.

Science Notes.

There were 533 deaths from the plague in Bombay during the week ending February 16.

A department of prints will be established by the New York Public Library, and will cover the entire range of graphic arts, like the collections at Paris and London.

The Doge's Palace, Venice, is being endangered by the weight of 200,000 volumes which have been in it since 1812. The Italian government has appropriated funds for their removal.

Frederick L. Olmstead has been appointed by Harvard University as instructor in the course of landscape architecture, which will be offered next year by the Lawrence Scientific School.

At one place in England, at least, slates are washed twice a day with a disinfecting fluid. The slates of children should be carefully inspected and great attention should be paid to the sponges with which they clean them.

A botanical garden has been established at Coquilhatville, Congo Free State, by the Belgian government. It will be called the Kew gardens, and it will probably be very important to the rubber and other tropical industries.

The Geographical Society of Philadelphia is to continue its work of setting wooden casks adrift on the ice north of this continent, to demonstrate the currents of Arctic waters north of Behring Strait. Each cask will contain a blank to be filled in by the finder.

In order to facilitate traffic along the shores of the Dead Sea it has been decided to establish regular intercourse by means of small steamers, and the first steamer has been purchased. It will certainly be a shock to many to hear of a steamer on this historic body of water.

The deepest ocean temperature which have been recorded were taken by the United States steamer "Nero," which is sounding for the cable between Guam and the Midway Islands. At a depth of 30,420 feet the water had a temperature of 35·9 degrees Fahr., and at 9,060 feet it was 36 degrees Fahr.

Prof. Stewart Culin has been appointed lecturer on archæology and ethnology in the University of Pennsylvania. Prof. Culin has been connected with the Museum of the University and is curator of the Section in Asia, and General Ethnology in the Free Museum of Science and Art which now offers for inspection an almost unrivaled collection.

Henry Cabot Lodge has introduced a bill to secure for books from public and incorporated libraries second-class rates, that is one cent a pound. This would, of course, add largely to the postal deficit, as books cannot be transported for a cent a pound, but at the same time it would probably not be used to such an extent that it will entail a very serious loss, and it will undoubtedly be a boon to many individuals.

There is one article of American manufacture which is not exported to any great extent and, that is the American umbrella. They are the best in the world, the design being excellent and they are light in appearance, and owing to labor-saving machinery they can be produced at very low prices. A considerable portion of umbrella cloths, however, are imported from Europe as well as a considerable amount of the wooden sticks.

In 1881, says The London Lancet, Liverpool possessed no ambulances of any kind, except a two-wheeled conveyance something like what we term a "push-cart," and an instance is cited in which two gentlemen, who had their legs fractured on ocean steamers, arrived at that port, and great crowds were attracted by the spectacle of their removal to a hotel, and their progress was much impeded by the people. The system in operation in the United States is again recommended.

At Bicknoller St. George, near Taunton, England, there is a vigorous yew tree growing on the top of the square church tower, and though it has been cemented around, it still flourishes. There is an old yew tree in the churchyard, and it is probable that the birds have, after eating the fruit, left the seeds on the tower, while the mortar was soft, and one of these germinated. The yew tree is 2 feet 8 inches high with a girth of 12 inches. It is thought to be at least a hundred years old.

A unique institution for the treatment of sufferers of tuberculosis is being built near Palermo, Sicily. Its site is a magnificent one, and the edifice itself will be beautiful, and will be surrounded by temples, grottoes and marble benches, and at night the grounds will be illuminated by thousands of lamps. The medical director has made a special study of the fresh air and ample diet system of dealing with phthisis in Germany, says The New York Tribune. A French chef will be an important member of his staff. A yacht of 300 tons will also be at the service of those who desire it. Accommodations for a hundred will be afforded. After current expenses, and the expense of repairs have been earned, all surplus receipts are to go to sanatariums for the poor.

Engineering Notes.

The Roebling Company, of Trenton, have made a model of the Brooklyn Bridge for exhibition at the Paris Exposition. The length will be 28 feet.

There are now 214 transports engaged by the British government. They aggregate 1,050,359 tons, the largest is the "Cymric," of the White Star line which is of 12,552 tons.

The famous Kinzua viaduct on the Erie Railway is to be replaced by a newer and stronger structure. Its total length is 2,050 feet and its height above the surface of the water is 302 feet.

The Ordnance Bureau of the United States Navy is experimenting with a new explosive called "marsite." It is supposed to be a nitrate compound and can only be exploded by the combined force of percussion and concussion.

It is said that the largest belt ever made was turned out by a Canadian concern. It measures 3,529 feet long and is of rubber, its weight being 9 tons. It is made for the grain elevator of the Intercolonial Railway at St. Johns, N. B.

Some years ago the Union Steamship Company's vessel, "Norman," was fitted with appliances for reducing the temperature in the library and reading room, says The Engineer. This was appreciated by the passengers who flocked into the spaces cooled at every available oppartunity their comfort during their passage through the tropics being greatly enhanced thereby.

A curious accident recently occurred in Germany. An express train ran into the rear of a freight train, and in the rear car was a tank filled with spirits which, exploded as the locomotive ran under it. Three men in the mail car were burned alive and the engine, tender, mail car, baggage car, dining car and three freight cars were destroyed by fire, says The Railroad Gazette.

A curious accident occurred in Dublin on February 14. It was somewhat similar to one which occurred in Paris a few years ago. The rails were slippery, and the result was that the locomotive dashed through the walls of the terminus, smashing stationary buffers at the end of the platform and boring a hole through the wall itself. The engines was suspended in midair on a portion of the wall, 30 feet above the street.

Congress is to be asked to appropriate a considerable sum for the Philadelphia mint, including boilers, engines, dynamos, pneumatic tools, lifts, telephones and machine tools, coal handling machinery motors, etc., as well as a fine equipment of machinery connected directly with the coinage of money. It is thought that in a few years the mint may be relied upon to produce most of the machinery and appliances for all the United States mints.

A fire in a large spice mill adjoining the Chicago Public Library gave the first opportunity for testing the water curtain, the apparatus for producing which, forms a part of the equipment of the building. Tubes are arranged on the outside of the building on the top through which water can be turned, and the arrangement proved perfectly satisfactory. Streams of water poured out of the tubes covering the walls, and owing to the temperature they were coated with ice in a few minutes.

Some of the conveniences of a modern railroad station are mentioned in Mr. Francis' paper on the South Terminal Station at Boston, delivered before the American Society of Civil Engineers. It includes in addition to the usual ticket selling booths, dressing rooms, newspaper booths, etc., private telephone exchange for the use of the terminal station, bicycle racks, speaking tubes, a stand for the sale of emergency articles such as rubbers, umbrellas, etc., shoe-cleaning facilities for women, dressing and checking rooms for passengers, employees, etc.

A new breathing apparatus has been invented by an Austrian. It is for use as a rescue apparatus for coal mines. It consists of an India rubber cloth receptacle made in the form of a collar which closely surrounds the wearer's neck, serving as a breathing bag, and at the same time to hold a store of quicklime for absorbing the carbonic acid and water vapor. A mask tightly enclosing the face, is also employed and oxygen can be breathed from an accompanying container, so that a man wearing these appliances can remain in a locality filled with irrespirable gases.

A salt water detector between the condensers and boilers of cruisers has been determined upon by the British Admiralty, says Engineering News. This would obviate a recurrence like the breakdown of the "Pegasus" last February. The condensers of this vessel leaked badly and the salt water in her boilers caused them to prime to such an extent that the cruiser was practically helplesss for sixteen hours off Cape Ushant. After temporary repairs to the two boilers it reached Plymouth. The detector is an appliance for chemically testing the water during its passage between the condenser and boilers, at once indicating the admission of salt water.

Electrical Notes.

The local Street Railway Company, of Tokio, Japan, has decided to lay down 200 miles of electric railway.

An electric pneumatic brake has been adopted for the equipment of the Metropolitan Railroad in Paris.

An inventor has recently devised an illuminated sign which is sunk flush in the pavement consisting of a large dead light bearing a sign secured in a metal ring and a conical reflector, at the bottom of which is located an incandescent light.

In Hamburg the policemen on the streets are instructed to watch the cars sharply, and if they find a car which carries a single passenger more than the number allowed by law, the conductor is find 72 cents. It would be amusing to see the operation of such a law in this country.

There are now 93 German towns or districts with electric railways as compared with 77 of the previous year. There are 30 new lines projected and in projected and in progress, and 39 extensions. The total length of the lines is 1,270 miles. The total length of track is 1,750 miles, the number of motor cars is 4,504, with 3,139 trailers.

It is proposed to utilize the River Cellina and part of the River Piave in Italy, for the generation of electrical power for transmission to Venice. The Cellina is capable of supplying 10,000 horse-power at a distance 59 miles. The Piave scheme offers 27,000 horse power conducted 43 miles distant and the amount could even be increased, says The Electrical World.

On December 4 direct telegraphic communication was opened from Budapest to London. This is destined to be of great value to grain dealers, for Hungary is the granary of Europe. Telegraph messages formerly required three or four hours to pass from London to Budapest owing to the number of messages intended for these two places as they had to pass over the same wire used for business with Berlin and Vienna, so that a question and its reply usually occupied six or eight hours.

Mr. Howard B. Little in Knowledge discusses cases of trees shattered by lightning and cites an extraordinary case. A tree was encircled by a rope some 25 feet from the ground, and it so chanced that an end of the rope stood out from the bark of the tree so that during the earlier part of a rainstorm the tree was damp from the top to the rope, while the lower portion of the trunk was kept comparatively dry. The tree was struck in this condition and the lower part only was damaged. The damage followed downward a path which the twist in the fiber of the wood made easiest.

A bill has been introduced in the New York Legislature, requiring the registration of electricians, says The Electric Review. The bill is in the nature of a protection against fire, as it is to prevent incompetent persons from tampering with electric wires in all buildings where electricity is used. The electricians who wire the buildings are now held responsible for their work, but they claim that after they have finished it, in many instances, inexperienced persons are called in to do odd jobs, and leave the wires in such shape that they are a menace. The bill, therefore, would not permit any but registered electricians from touching the wires.

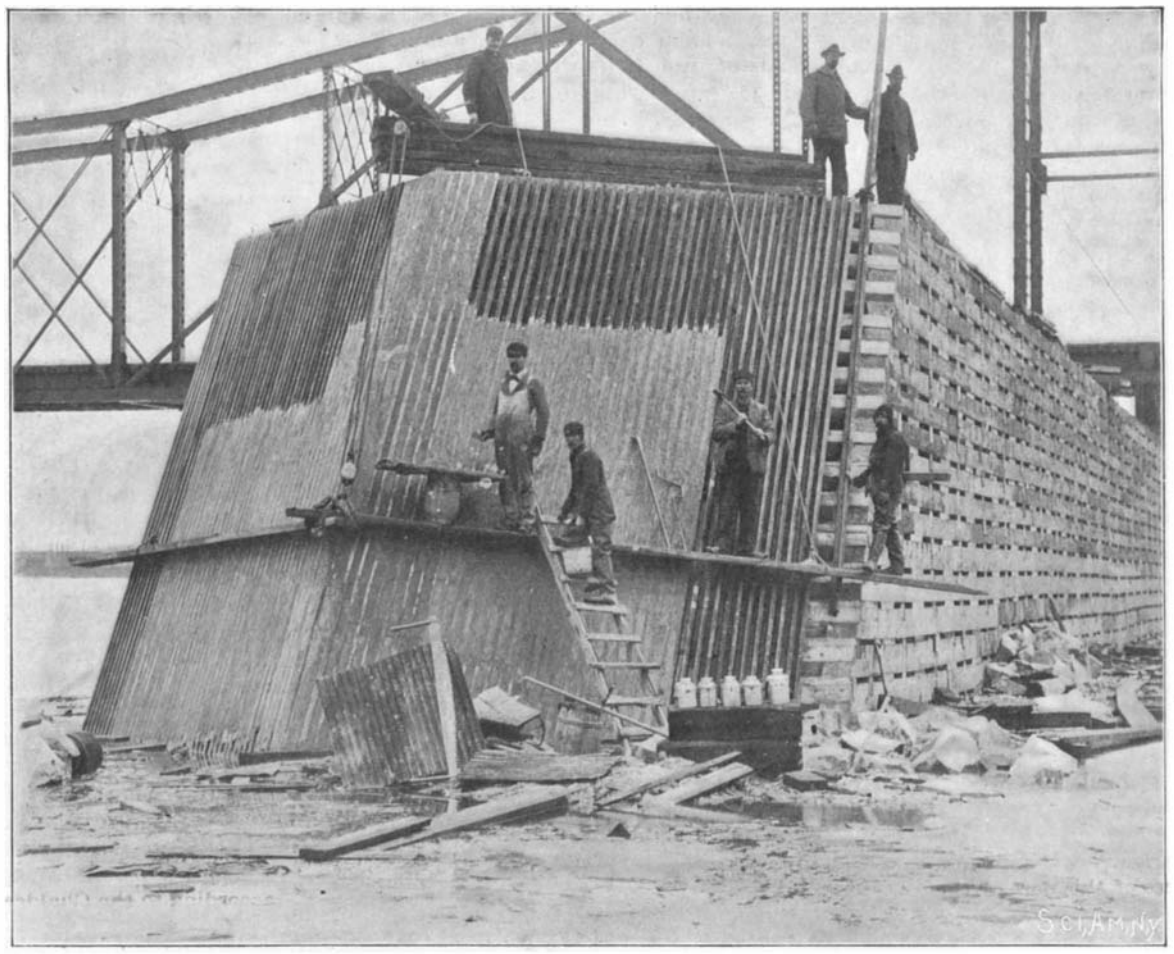
A new system of railway traction has been invented by a New Zealander, in which half of the car is underground and half above. It is proposed to construct a conduit of sufficient capacity to receive the truck and running gear. Attached to the truck and passing up through the slot are thin wide bars of sufficient cross-section to support the body of the car. Special provision is made to facilitate passage around curves. There are, of course, distinct advantages connected with such system, but the Franklin Institute which has investigated it, thinks that the disadvantages of inaccessibility to the truck mechanism, especially in the case of electrical railways where prompt access to the motors and the connections is of the highest important, would more than offset the advantages claimed for the system. The Street Railway Review concurs in this opinion.

A patent has recently been issued for an invention having for its object the giving of an audible alarm through the agency of smoke or non-flame-supporting gases, such as are ordinarily generated by fire. The device is based upon the principle that a gas flame only burns when supplied with a definite amount of oxygen. The flame is allowed to act upon a thermostatic bar included in the electric circuit in connection with that of an alarm of any approved form. The circuit is normally open as long as the flame continues, and the arrangement being such that when the flame is extinguished the circuit will be closed thereby causing an alarm to be sounded. There is a perforated casing containing a gas flame which supplies heat to the bar. Should the surrounding atmosphere be filled with smoke or non-supporting gases they will be drawn into the casing. The flame will be extinguished from lack of oxygen to support combustion and the thermostotic bar in cooling closes the circuit.

THE LATEST OF THE LARGE MISSISSIPPI BRIDGES.

The fact that the Mississippi River, running in a general north and south direction, intercepts the main trunk lines to the West, is responsible for some of the most notable of the great bridges of the world. The Bismarck Bridge, on the Union Pacific Railway, the Eads and the Merchant Bridges, at St. Louis, and the handsome structure designed by Morrison for crossing the river at Memphis, are structures whose fame is known the world over. The latest great crossing of the Mississippi is the symmetrical and altogether beautiful structure which forms the subject of the accompanying illustrations. It forms an important part of a new line of railroad connecting the cities of Davenport and Clinton, Iowa, with Rock Island and Moline, Ill. The railroad and the great bridge are something more than a mere connecting line between the cities named, for the towns at each end of the line are the meeting points of a number of the large railway systems of the West. The Davenport, Rock Island and Northwestern Railroad is located along the right bank of the Mississippi from Clinton to Davenport, from which point it swings with a long curve to the south before crossing the river. The line itself has been constructed since the middle of September last; but the bridge has been under construction for about two years.

The crossing is made up of seven fixed spans with a draw span over the main channel, its total length being 2,310 feet. Commencing at the Rock Island side, from which the accompanying illustration was taken, the bridge consists first of three spans of 200 feet, then a draw span 442 feet between the end pins, followed by four fixed spans, the first 365 feet in length and the others each 300 feet in length. The total length of the viaduct approaches is 850 feet, the spans of which vary from 30 to 70 feet in length. The superstructure, which was built by the Phœnix Bridge Company, is of the standard American type throughout, with built-up lattice, posts and chords, and eye-bars for the tension members. The bridge is carried upon masonry piers, the foundations for which were carried down by the pneumatic process. The draw span is electrically operated.



STEEL RAIL AND CEMENT FACING FOR PROTECTION OF PIVOT PIER—DAVENPORT BRIDGE.

THE LATEST NOTABLE BRIDGE ACROSS THE MISSISSIPPI.

On the Line of the Davenport, Rock Island and Northwestern Railroad.

Three 200-foot spans; one 442-foot draw span; one 365-foot, and three 300-foot spans; Viaduct approaches, 850 feet. Total length, 3,157 feet.

As the pivot pier of the draw span is exposed to floods and to a heavy flow of ice it is protected by a fender pier on the upstream side. This pier is a continuous timber crib 26 feet in width, 250 feet long and 28 feet in height, the water at this point being 7 feet deep at its lowest stage. The crib is strengthed by four interior longitudinal walls, and by a series of transverse walls spaced 8 feet, center to center. The nose of the crib at its upstream end is formed with an angle of 90 degrees.

To protect the cutting edge at the nose from heavy floating driftwood and the action of ice, it was at first proposed to cover the inclined surfaces with a fencing of heavy steel plates; but owing to the difficulty in fastening and holding the same, and providing the necessary backing, it was decided to sheath the nose with a protection of old rails. The rails which weigh 65 pounds to the yard were laid up the face of the slope in 28-foot lengths. They were spaced 5 inches apart, center to center, and were fastened with ordinary railroad spikes to each horizontal course of cribwork. They were also secured by drift-bolts which passed through holes in each side of the flanges, and were secured by nuts on the inner side of the timbers of the cribwork. After the rails were all in place the intervening spaces were filled up with cement mortar so as to afford a practically smooth surface and avoid any roughness which would tend to cause a lodgment of driftwood or ice against the nose. The whole of this important work was designed and carried out by Mr. C. F. Loweth, M. Am. Soc. C.E., to whose courtesy we are indebted for the accompanying illustrations and particulars.

A Novel Apartment House.

Plans have recently been filed in New York city for a seventeen-story apartment house, says Carpentry and Building, which has some novel features. It is to be built on Fifth Avenue, just across the street from a famous restaurant. The elevator shafts of the new house will be sunk deep in the ground so that passengers can enter a tunnel extending under Fifth Avenue and communicating with a system of elevators connecting with the restaurant which will be remodeled so as to reach the tunnel entrance. In this way the residents of the apartment house can, by means of an underground passage, reach the restaurant and return to their rooms without the necessity of going out doors. The tunnel will be handsomely fitted up and the building will have a swimming tank of large area and luxurious accessories.

Value of Farm Animals.

The statistician of the Agriculture Department has made some interesting computations as to the number and value of farm animals in the United States. On the first of January there were 13,537,524 horses, 2,068,027 mules, 16,292,260 milch cows, 27,610,054 other cattle and 41,883,065 sheep. There has been a total increase in value of the country's live stock during the year 1899 of $216,000,000, not including the increase in the value of swine, no figures concerning which are at present available. The total value of farm animals of the United States on January 1, 1896, was $1,997,010,407. The present value is not less than $2,213,010,407. The number of horses has decreased largely. There are nearly 3,000,000 fewer horses in the country than there were seven years ago and there are fewer mules than since 1886. The average price per head for mules is $53.65. This is a higher price than has been paid since 1894, and the result was evidently produced by the unprecedented demand for mules by the Spanish-American and Transvaal wars.

Rifle Ranges for Cities.

The events in South Africa have brought about a widespread interest in England in rifle practice, and what is wanted is some system of closed safety short ranges, such as are so much used on the Continent, so that the members of the rifle clubs can attend them. The firing point is usually closed in, and on the inside is a sloping bullet-proof penthouse roof, which effectually prevents any accidental shot flying off into the street. High walls with cross screens at gradually increasing distances, in which are openings corresponding to the targets provide for the safety of the neighborhood, while a further precaution is provided in the shape of a sloping screen above the targets themselves. These could be self-registering, or a covered way to a marker's butt might be easily made from the firing point. An illustration of such a daily range is given in a recent number of The Daily Graphic. In France shooting at a mark forms one of the lessons taught at the primary schools, and there are in that country 1,800 shooting clubs, with a membership of 14,000. Switzerland has 3,300 rifle clubs, with nearly 200,000 members, out of a population of nearly 3,000,000.

Yale University is to establish a school of forestry. The large estate bequeathed by the late Prof. O. C. Marsh will be used as a school of botany, and will also be used for the present as a school of instruction in forestry. There is certainly a great need for thoroughly scientific schools of forestry, when extremely valuable growths of trees are now rendered entirely worthless.

M. J. DE MORGAN'S EXCAVATIONS IN THE AKROPOLIS AND PALACES OF SUSA.

The excavations of M. Jacques de Morgan at Susa in Persia, are of the greatest possible importance owing to the proof which they present of the Asiatic origin of Egyptian civilization, and also as indicating that the ancient Elam was the cradle of the Aryan race. Through the courtesy of the Rev. Henry Mason Baum, D.C.L., editor of Monumental Records, we are enabled to present some interesting particulars of M. de Morgan's work at Susa largely in his own words, and also to give a portrait of this archæological explorer in his study at Susa, where he is superintending the work of 600 men. M. de Morgan was sent to make these excavations for the French government which has secured from the Shah the monopoly of archæological excavations, and the French explorer sends regularly reports to the French Secretary of Public Instruction.

We cannot give in extenso the report of M. de Morgan's work, but we will review the most important results obtained. In the current SUPPLEMENT will be found an account of M. de Morgan's trip from Teheran to Susa and an additional account of certain of his excavations. On his arrival at the latter place the explorer first examined the mounds to see if the observations that had been made during his previous visit in 1891 were correct. He considers that the "tells," or mounds of Susa were formed by the accumulation of rubbish and débris left by the successive occupants of the city. At the present time M. de Morgan speaks only of the archæology, reserving for a later report notices of the natural history, ethnography, modern linguistic geography, meteorology, architecture, etc. During the first season spent at Susa he encountered all kinds of difficulties which are always met with in a country so little civilized and as fanatic as Arabistan is. The population although tractable enough had to get used to European methods of labor and the local government in spite of the Shah's firmans did not realize at once their meaning.

M. de Morgan spent the entire winter busying himself in organizing the work, assisted by M. G. Lecquier who directed the diggings at the Apadana and a scientific and executive staff. M. de Morgan's first care was to carry through the mound of "The Citadel," mining galleries were run in order to study the various levels before starting any open cuts. Guided by the inspection of the débris met with on the ground he opened five galleries at the east of the extremity of the mound. In 1891, he noticed that the slopes of this part of the tumulus contained more cut flints and a greater number of fragments of painted vases than any other part of the ruins. He was positive that while working through these thick beds he would find the remains of the oldest civilization.

M. de Morgan describes his researches in detail, and goes on to say:

"I have found at various levels, and also at the surface of the tell, quite a great number of pieces from sickles, some having retained the bitumen used in fastening them to the wood, nearly all show on the edge a polish that has been given by use. The same fact is always observed in Egypt. I have previously made the remark in my '*Recherches sur les Origines de l'Egypt*,' that the culture of wheat could never have originated in the Nile Valley, cereals not existing in an aboriginal state in Egypt. I have relied on this fact among others in my attempt to prove the Asiatic origin of the first Egyptians, or at least of their civilization. This argument would have had a far greater value had I known, as I have today observed, that the same tool provided with flint flakes was used in Mesopotamia, as well as in Egypt, for harvesting grains, which here are growing naturally all over the country, and even on Susa's tells."

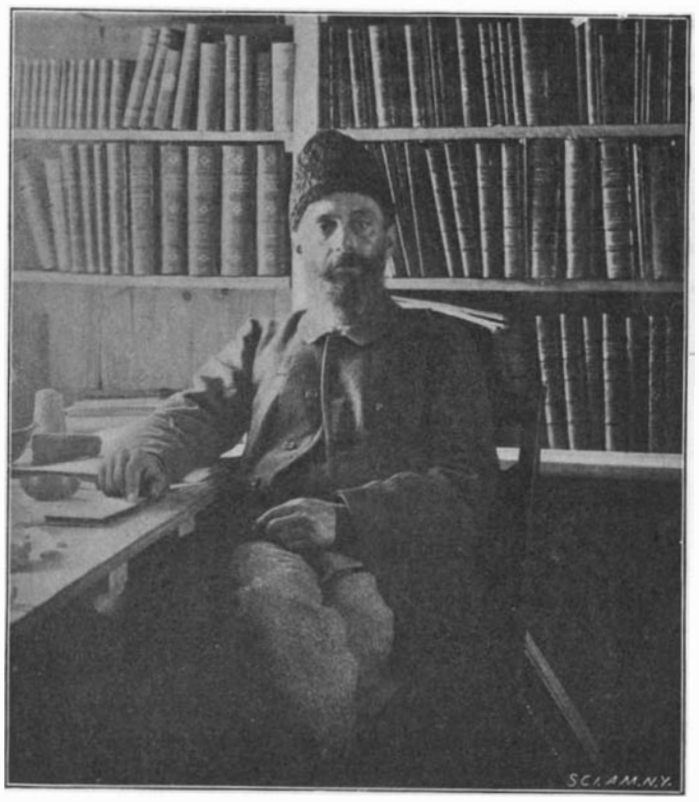
The sixth gallery, which was only 29 feet below the summit of the mound, was most interesting, a well lined with large terra cotta tubes, cemented with plaster, being found and at last a baked brick wall. The small amount of material extracted from the galleries did not permit of determining with absolute certainty the nature of the various beds forming the mound of the Susa citadel, but the excavations have supplied valuable information to guide the explorer. We know now that the level of the first or Anzanite city is 12 feet below the one that was destroyed by Assurbanipal's soldiers.

Assurbanipal tells us that before his coming to Susiana, Susa had never been captured by foreigners, so we must expect to find in perfect order the remains of the various Anzanite civilizations. For we know from the informations furnished by the galleries that at all times the site of Susa was inhabited.

We also know that the levels of the various epochs are coming in regular sequence down to the beds containing the remains of the prehistoric period. Then it will be sufficient to successively remove the various beds in order to be able to draw the plans and separate the documents of the various epochs. The trenches are indicated on the diagram and some of the finds were very important. The first trench was 536 feet long, 13 feet wide and 16 feet deep, and was intended for exploring the southern portion of the mound known as the "Royal City." At a depth of about 3 feet we found substructions and foundations of buildings of a late period (Seleucic, Parthian and Sassanian. The walls were of flat square bricks, and the houses were divided into small rooms. The dwellings were provided with water mains intended to gather the products of the rain on the terraces and to collect it into cisterns or reservoirs.

THE GREAT STELE DISCOVERED AT SUSA—ERECTED BY KING NARAM-SIN 5,650 YEARS AGO.

MAP OF EXCAVATIONS OF SUSA IN PERSIA.



J. de Morgan

M. de Morgan gives an account of the various objects which have been found including a bronze table granite obelisk and most important of all the stele shown in our engraving, the largest monument exhumed at Susa. It is 6½ feet high, and 40 inches wide.

He says: "At the top are three singular representations of the sun with its rays. Below is the helmeted king, armed with an arrow in the right hand, a bow in the left hand, he wears a semi-long costume and sandals, a dagger is passed through his belt. His beard is long according to the Chaldean and Assyrian fashion. This figure treads under his feet dead enemies, while in front of him another one falls wounded and attempts to pull out the arrow which pierces him; further still another one raises his hands as a sign of supplication. Under the king's feet are heaped up dead bodies, some of them remarkably treated, their attitude is correct and very elaborate. Below the king, and ascending a grade, are three standard bearers, the left hand resting on the dagger fastened in their belt, the right holding the banner. These figures wear a long dress and a helmet.

"The whole scene takes place in the mountains; the king, followed by his standard bearers and soldiers, is pursuing his enemies as far as an abrupt peak entirely covered by a long inscription. Other enemies are playing in the forests or making their submission. Unfortunately, this stele had to stand the effects of a big conflagration; the stone has been split in many points and one of its scalings has carried away the whole text that stood above the king's head. I had to consolidate the base with plaster in order to be able to take a substantial squeeze of this monument and so preserve this document, for I fear that it will not stand transportation. In spite of these injuries this stele is a very important monument of Elamite art. The composition is well put together and the execution entirely satisfactory; the figures are of good proportion, well treated in the ensemble and in the details, showing that the Anzanite had reached to an artistic skill in no way inferior to what we know of their neighbors, the Assyrians and the Chaldeans." Father Scheil considers that it was of Babylonian origin and that it was erected by King Naram-Sin, the son of the famous Sargon, about 5,650 years ago.

The buildings in the citadel may possibly have been used as a treasure house by the Persian kings, for when Alexander captured Susa, he found there 9,000 golden talents. In trench No. 3, M. de Morgan found important remains of Anzanite buildings, and the aspect of the place proves that the Anzantine Susa was set on fire. Assurbanipal says: "I destroyed the tower of the city of Susa, whose base was of marble. I turned its walls upside down. During a month and a day I swept the country of Elam from one end to the other. I took away from its fields the voices of men, the sound of joyous music. I brought into it savage animals, serpents, the beasts of the desert, and the gazelles." The old king truly waged bloody wars, and he describes them in true Asiatic

fashion, his language glowing with Oriental imagery.

M. de Morgan's conclusions are most important. He thinks that the main Anzanite spots are the citadel and the "Royal City." At the time of Susa's destruction by the Assyrians all the monuments that could not be carried away were upset without being damaged. After Susa's capture by Alexander the Great, no important buildings seem to have been erected at Susa, and it seems to have disappeared entirely before the beginning of the Sassanian dynasty. He considers that the Archæmenian ruins will hardly repay extensive investigation as they will add nothing to history. He says that he intends to concentrate his labors on the Elamite remains, their importance making this a duty. He hopes that the inscriptions will add to history the names of whole dynasties, and it is the life of a nation during 3,000 years that must be reconstructed with the aid of the monuments. During the last season he had ten small railway cars at trench No. 7 and next season he will have fifty for transporting material. He thinks that in four or five years the whole of the hill can be cleared down to the most ancient Anzanite level. He intends next year to open five trenches in the mound of the citadel. With the material at hand he expects to be able to have the whole mound reveal its secrets, possible within ten years, certainly within twenty years. The abandonment of Susa was brought about, thinks M. de Morgan, by a change in the course of the river. The ancient Anzan, or Elam, is held by many to be the cradle of the Aryan races. There was a high degree of civilization there 8,000 to 11,000 years ago. The mounds hold one of the keys of history.

M. de Morgan is now in Paris preparing for next season's work.

Automobile News.

An automobile club has been organized in Baltimore.

There are five automobile clubs in Belgium and their combined membership is 740.

An automobile race will take place in France during four days of the last week in July.

The Chicago aldermen are considering the advisability of requiring automobile owners to provide their vehicles with fenders.

An automobile cab almost demolished a coupe in Fortieth Street, near Sixth Avenue, New York city, on March 6. The vehicle was an electric one and in some unknown manner the driver lost control of it.

The Western Electrician states that an arch is soon to be erected at the extremity of the Avenue de la Grand Armee, in Paris, to the memory of Levassor as he did much to promote the interests of the automobile. The arch is to be surmounted by a reproduction of the latest type of automobile. The French do not give arches lightly so we cannot vouch for the truth of this statement. Their taste, however, can be relied upon to soften the shape of an automobile if it becomes necessary to make it a detail in a work of sculpture.

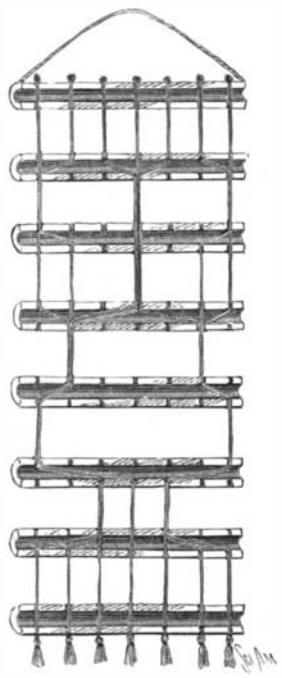
A steam automobile was left unguarded with gear reversed a few days ago in front of a theater. A mischievous boy climbed into the vehicle and opened the throttle. He jumped just in time and the carriage started backward at a high rate of speed for Broadway; the thoroughfare being crowded with pedestrians. The vehicle suddenly swerved and leaped the curb and pinned an unfortunate pedestrian against a lamp post. The driver by this time had reached the scene just in time to be arrested. The injured man was taken away to a hospital and the automobile was loaded into a wagon and taken to a repair shop. The driver was arrested on the charge of violating a city ordnance in leaving a vehicle unguarded. It is stated that there was no way to lock up the machine so malicious or inquisitive persons could not tamper with it. There have now been so many accidents of this nature that it would really seem as though no automobile should ever be left without a guardian.

A curious accident occurred in the store-rooms of an automobile company in New York city. A cleaner was inspecting machines on the cleaning and polishing floor. Orders had been given not to move the machines by motor power on the floor. The steam had been generated in the boiler over a gasolene burner for the usual tests and when it became necessary to move the vehicle, the young man jumped abroad and started the motor. The seat had been removed in order to watch the test of the boiler so that the cleaner stood upright. The carriage was run near the opening to the elevator shaft; it was then stopped and the man intended to back it into its place, but instead of moving the reverse lever he moved the throttle lever and the heavy vehicle plunged against the steel gate of the shaft. Unfortunately it gave way and both man and machine went over the edge. The man first reached the ground some 60 feet below, and the vehicle banging from side to side of the shaft fell on him and crushed his skull so that death was instantaneous.

THE CHINESE RODS AND CORDS.

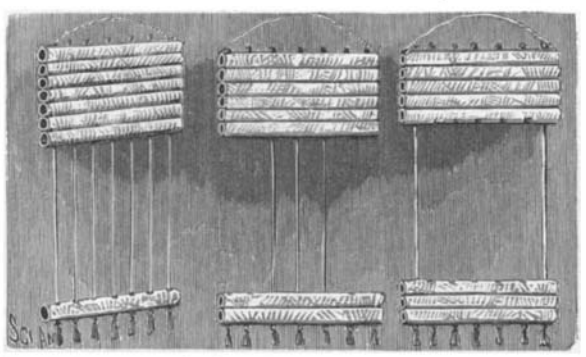
Nothing excites curiosity in the public mind more than a simple and clever puzzle, and the "Fifteen Puzzle" and "Pigs in Clover" have given enjoyment to hundreds of thousands. The Chinese rods and cords which forms the subject of our engraving is in the line of ingenious disposition and is really more in the nature of a trick than a toy.

It is of Chinese origin and the example shown in our engraving was purchased in Chinatown, San Francisco, Cal. The puzzle consists of eight pieces of bamboo or hollow ivory tubes, each containing seven holes spaced equidistantly. Through these holes are seen to pass seven silken cords, each with a bead at the top and a tassel at the bottom. The toy is held by the loop at



THE ILLUSION EXPLAINED.

the top, which serves to hold the upper rod. When it is first picked up, its condition is shown in our second engraving at the left. There are seven of the rods at the top, and one at the bottom. Now the lower bar of the upper set is moved down to the bar at the bottom, the two lower bars will appear to be supported by three cords at the center, as shown in our engraving, four of the cords having vanished. If the next bar is brought down, another change is observed, only the two outer cords being seen. This is shown to the right of our engraving. If the next bar is brought down, the end cords have approached the center, and five of the seven cords have vanished. The next rod brought down brings five cords into view, the two end ones and the center one being visible. When the next bar is pulled down, the center and the outer cords only remain, so that if all the bars between the top and bottom bars are brought together, the seven cords appear to pass entirely through them. Our first engraving gives a clew to the mystery. The rods are all hollow, and each contains seven holes, and our engraving shows the course of the silk cords. It will be noticed that where a number of cords pass through a single hole the strand which is formed is much thicker than are the single cords; as they are of different colors, the



THE CHINESE RODS AND CORDS.

effect is most pleasing. It will be observed that the strings go clear through the top bar, but in the next bar, although they enter the seven holes at the top, they emerge from three holes at the bottom; three of the strands going through the center hole and two through each of the end holes, and so on throughout the entire number of bars, the strings changing their course, as is clearly shown in our engraving, thus causing the increase and decrease in their number.

A Memorial of the Centuries.

Colossal crosses are to be erected this year on nineteen mountain peaks of Italy to commemorate the nineteenth century of the Christian era. A religious society will have charge of the matter. The crosses will be cut from granite, marble, or whatever stone characterizes each region, and will bear an inscription.

Correspondence.

Foreign Trade Marks.

To the Editor of the Scientific American:

Your notice addressed to American merchants in the Scientific American reminding them that some merchants do not understand that in foreign countries the first registrant of a trade mark becomes the legal owner thereof is most timely.

We are continually receiving evidences of the truth of your remarks. Great hardships frequently arise to foreign merchants simply because local traders have applied for and have been granted trade marks which are identical or somewhat similar to those of foreign manufacturers. These latter at a subsequent date have applied for and then found to their cost that they were out of court.

An instance occurred just recently where it cost an English manufacturer several hundred dollars to have the register rectified by the removal of the mark of which he was the first and true inventor. Had he only applied, without unnecessary delay for the mark, he could have done it practically speaking for a few dollars. His loss, therefore, was great. And fortunate was he that it was not greater.

Trusting that the merchants of America will be quick to realize the dangers that are incurred in not applying within reasonable time for their trade marks we would remain yours faithfully,

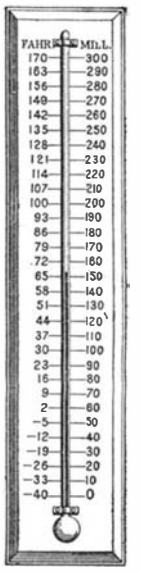
Edwin Phillips,

Melbourne, Australia, January 30, 1900.

A MILLIGRADE THERMOMETER.

To the Editor of the Scientific American:

I have devised the new milligrade thermometer, the only perfect thermometer in all the world. True to name, it has in its scale 1,000 degrees. As mercury is the substance in general use, the 1,000 degrees shows the full tenacity of mercury, for a thermometer should be graded according to its tenacity. In milligrade mercury freezes at zero and boils at 1,000. This scale is to Fahrenheit as 10 to 7. The French centigrade is really a three hundred and eighty-niner, while Fahrenheit is a seven hundreder (660 + 40). In a true centigrade thermometer, not enough would be implied in a degree, so we minify the degrees ten times and use milligrade—the only perfect scale that will ever be devised. It will register in all minutiæ. Decimals will not be needed. No below zero temperatures as long as mercury has power. Everybody knows positive and negative characters are a nuisance in computation, and milligrade ought to be international. It is worth striving for. Water boils at 360 degrees—the number of degrees in a circle. The point of aqueous congellation is just above a hundred (102°). The first hundred is the winter hundred of our northern latitudes. The second hundred is our summer hundred, and the hundred figure is easy writing and easy adding. 200 milligrade = 100 Fahr. It seems to me the simplicity of this scale should be its chief recommendation.



Arthur Betts.

U. S. Vol. Observer, Ridgeway, Iowa.

A Dynamometer Car.

A new dynamometer car is being built in the shops of the Illinois Central Railroad, and will be operated by the railway company and the Department of Railway Engineering of the University of Illinois. It will be equipped with apparatus and instruments for road tests of locomotives, air-brake tests, and line inspection. The dynamometer recording apparatus will have three tandem cylinders, 3, 6 and 9 inches in diameter. By combinations of these, the apparatus can be tested with any weight of train. The apparatus for track inspection will automatically record deviations from gage and level of rails, the superelevations of rails, curves, the time, distance, etc. The motions are transmitted from an independent pair of wheels under the car to small cylinders in the car, transmission being effected by means of oils.

The pistons in these cylinders transmit the motions of the wheels below and their piston rods carry the pens by which the records are marked on a moving sheet of paper.

A Pipe Line for Sugar Juice.

At Springfield, Utah, there is a plant for slicing sugar beets and extracting the sugar laden juice by diffusion, and this, with its impurities is then pumped through a pipe line to a beet sugar factory at Lehi, where it is treated and refined by the usual processes. It is learned, says Cassier's Magazine, that the same system of piping sugar juices are also in use in France and Germany, and in the latter country also pipe lines have been used in potteries to carry much thinned clay paste from one department to another.

THE PASSING SHOW.

BY CHARLES F. HOLDER.

No more interesting study, for the laymen or man of science, can be found than the effect of civilization upon the fauna of a continent. In America the results have been so marked and far-reaching that it is of more than ordinary interest. Within comparatively few years some types of animals have been almost

THE CALIFORNIA VULTURE.

extermnated, others constitute a passing show, and without the most stringent rules and regulations they will soon disappear.

Among the most interesting birds on the Pacific slope is the California vulture—*Pseudogrypus Californianus* which well represents in North America, the great condor of the Andes, and exceeds it in stretch of wing, but not in bulk. I have seen this fine bird soaring high above the Sierras, and once succeeded in creeping upon a specimen which had come down into the lower country, and was in a grove of live oaks at an altitude of about 1,000 feet, in the San Gabriel Valley. I laid in the cover for some little time watching this great American vulture, which with head well up, its big wings drooping, presented a fine picture. I satisfied myself with aiming at it, then came out of my concealment to drive it away, knowing that the first pot hunter who came along would bag it as the bird was in demand by the insatiate curiosity dealers who have a price on the head of every bird. The great vulture slowly moved away with ponderous flight, and I watched it rise higher and higher in great circless congratulating myself on having aided, in all probability, in the preservation of at least one individual. A week later, however, I learned that a California vulture had been shot in the same grove by a sportsman, and brought to town, where it was sold to the highest bidder.

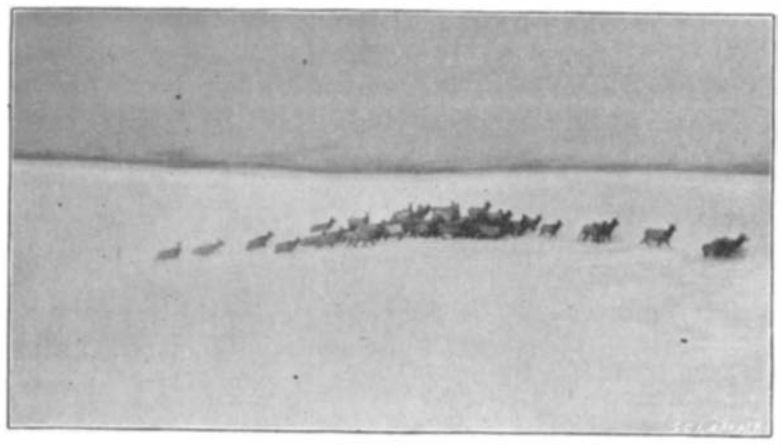
That the bird is destined to extinction is evident from the fact that every collector or curiosity dealer has a standing offer for all the birds and eggs they can get. Thirty or forty years ago these birds were so common that it was not unusual for the Mexicans to catch them with a lariat, roping them after the vultures had gorged themselves with food. I once had access to a large South American condor which I found very amenable to the taming process. After some weeks it came to know me, and would hold up its head to be scratched, like a dog. The living California vulture that it was my good fortune to see appeared to be quite as heavy and powerful a bird, though there is no doubt that the Andean form is the superior in this respect. As to their strength, Dr. Cooper states that four could drag the body of a young grizzly bear, weighing 100 pounds a distance of 600 feet. Dr. Newbury observed these birds in the Sacramento Valley in 1856, and refers to their fine soaring powers; and Dr. Canfield states that he has seen as many as one hundred and fifty vultures around a dead antelope in the Columbia River region. Southern California to-day is undoubtedly the principal retreat for the great bird, which will be hunted in the winter from peak to valley, and from one live oak grove to another until they too have joined the majority.

The disappearance of this bird can be traced to different causes: first, the pot hunter, who goes forth to kill everything; second, the collectors, who sell their "game," from blue birds to vultures, to curiosity dealers; third, poisoned meat set for coyotes and bears, and fourth, Mexican miners in Lower California, who it is said, destroy the bird solely for their plumes in the hollow part of which they deposit gold dust.

Among the doomed animals are the antelope and elk. A few years ago the plains of California were covered with antelope. Even so late as fourteen years ago hunters could find them in the old dry lake bottoms in the vicinity of Mojave; and fifty years ago the great San Joaquin Valley supported many bands. But the advance of the white man into the West has been fatal; they have been shot down, driven away, murdered in cold blood for their heads alone, and to-day are on the verge of extinction in California. As to the actual numbers in this State, Mr. H. W. Keller, State Fishery Commissioner, wrote me: "The only antelope I have seen or heard of are in the following localities. In the Mount Shasta foothills, about forty miles east of Yreba, Siskiyou County, I found about seventy-five head in small bands, running in the timber entirely, something unusual for this animal. There is also a small band in the western end of Antelope Valley, possibly less than twenty in all. There may be some in the counties bordering on the Nevada line, but of this I am not sure. I do not think that there are five hundred antelopes in the State."

The elk is disappearing so rapidly, despite the efforts on the part of the government to save them, that it would hardly be an exaggeration to say that within twenty years there will not be one left outside the limits of the National Preserves. Even this retreat is not a protection, and pot hunters and renegades haunt the borders, drive game into the open country and slaughter it. Elk in the territories and interior States are hunted in the deep snow of winter, made to "move on" from post to pillar, as shown in the accompanying photograph, until they, too, become but a memory. Fifty years ago elk could be found plentiful in California; and two hundred years ago the animals ranged the State and far into Lower California and everywhere over the great valleys, judging by the antlers found. How it is to-day Mr. Keller writes me as follows: "The only elk I know of in this State—California—are a few in the northern part of Humboldt County, and about one hundred and fifty in Kern County, west of Bakersfield."

Fifty years ago the fine natural harbor on the southwest coast of the Island of Santa Catalina, gave shelter to what was perhaps one of the largest herds of the California sea elephant—*Macrorhinus angustirostris*—then known, the largest of its tribe, many of the hulls attaining a length of 22 feet. It was a striking and conspicious object, and naturally attracted the attention of the whites who immediately began a war of extermination, the animal being very valuable for its oil, the large bulls affording two hundred or more gallons. The animals were very plentiful at this time from latitude 25° to 35°; but the war of extermination began about 1852, and the present decade has, in all probability, seen the last of the animals. The government recognizing the inevitable, sent an expedition to Lower California a few years ago, and secured all the sea elephants they could find; and the oil hunters have since then completed the work, and it is believed that this fine animal is extinct. Even in 1860 they were rare, and the history of their passing is not without interest. In 1880, it was rumored in San Diego that a few of these animals had been seen at Gaudaloupe and San Benita, and forthwith an expedition was planned to wipe them out. In that year the crew of the schooner "San Diego" killed thirty at San Cristobel Bay. Two years later forty were killed by another party, and six young ones were secured. In 1883, the American hunters rallied to the slaughter, the Mexican government offering no resistance, and killed one hundred and ten, fourteen being large bulls. Everything in sight was destroyed — males, females and young.

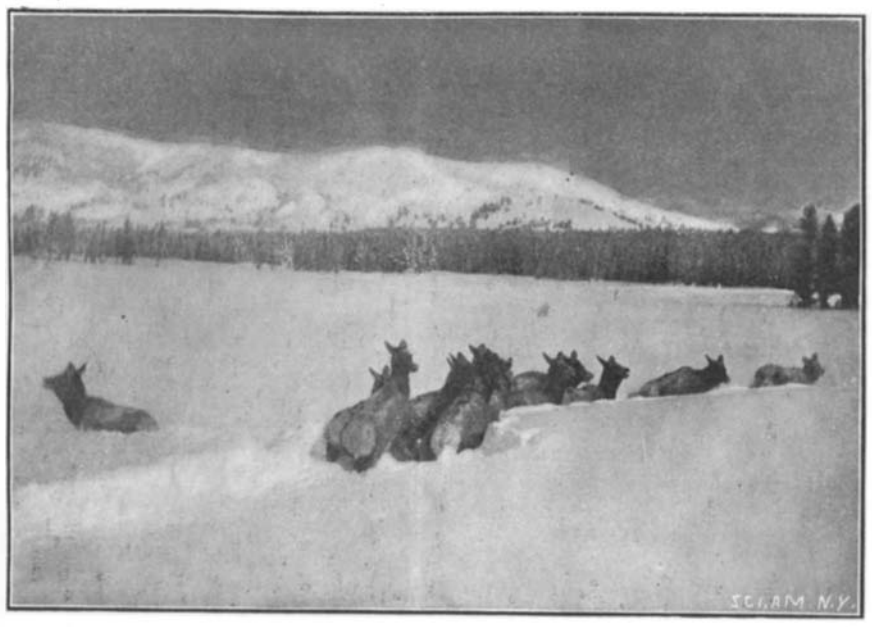


HERD OF ELK PASSING OVER THE PLAINS.

In 1884, the crew of the sloop "Liberty" killed ninety-three. These men had sentiment enough to leave a few females and young; but it was a mistake, as some weeks later another boatload of exterminators came along and slaughtered what was left of the herd. The government then sent Mr. Charles H. Townsend to secure what animals might have remained. He visited all the localities in Lower California, which had formerly given shelter to these animals, but found none until they came to San Cristobel Bay where there was a herd of fifteen, these being killed in the interest of science. These were probably the last of the race.

One of the most remarkable animals on the Pacific to disappear before the advance of man within the past one hundred and fifty years, was the rhytina, or sea cow—*Rhytina gigas*—which was discovered by Bering in 1741 on the island that was given his name. The surgeon of the wrecked party has left an interesting account of this Arctic manatee-an extraordinary animal, which attained a length of 30 feet and a weight of eight thousand gounds. The animal was found in herds about the mouths of streams, and being a clumsy creature, with no means of defense, easily became a victim to the party, who speared them for food. So vigorous was the warfare against it carried on that in nine years the five herds on Copper Island were extirpated; in 1763, those on Bering Island had been destroyed, and in 1768 the last one paid the penalty and the rhytina became a memory, the skeletons in the National and Russian museums, the San Francisco Academy of Science and a few others alone telling the story.

The great auk, the Labrador duck, and the do-do are examples of complete disappearance, while the Mascarene tortoise, the Carolina parrot, the West Indian seal and others are among the passing throng.



DESTRUCTION OF ELK IN WINTER.

The Current Supplement.

The current SUPPLEMENT is of very unusual interest. "The Conquest of the Sahara" is an elaborately illustrated article, showing actual sand waves. M. de Morgan's "Discoveries of Susa" is an attractive article, giving somewhat in detail a few of the important finds. There is also an article from M. de Morgan's pen entitled "A Trip from Teheran to Susa." "The Santa Ana Canal" is continued. "Improvements in the Three-Wire System" is by Alton D. Adams. "Mr. Marconi's Lecture on Wireless Telegraphy" is the title of an interesting article. "Disinfection and Prevention in the Sickroom" is by Dr. Charles Harrington. "The Method of Testing Road Metals" describes the procedure in the laboratory of the Maryland Geological Survey. The article is accompanied by an illustration. "Acetylene and the Manufacture of Mineral Blacks" is by M. Georges F. Jaubert.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

COTTON-PICKING MACHINE.—William L. Belt, 122 O Street, Washington, N. W., D. C. By this machine the cotton is extracted from the bolls by air-suction applied through the media of flexible tubes and fans. The invention is the result of long experience with pneumatic picking apparatus. When cotton ripens the bolls open first on the lower branches of the plants. The cotton nearest the ground is most exposed to dust and grit. It is, therefore, desirable to gather such cotton and deposit it in a receptacle separate from the other and cleaner portion. To this end the inventor has devised special air-suction and blast apparatus to operate on the lower bolls and other separate apparatus to act on the middle and topmost bolls.

BEET-PLOW.—William F. Schmidt, Blanco, Cal. The object of the invention is to improve a similar plow patented by the same inventor. The improvements consist in simplifying the construction of the standards carrying the points and lifters, in providing for lateral and vertical adjustment of the standards relatively to the main frame, in rendering the standards reversible, in furnishing braces for the standards at their upper ends, and in so constructing the points that they can be turned end for end and laterally adjusted, and extended for a greater or less distance in advance of the standards.

CORN-SHELLING MACHINE.—Charlie D. Prindle, Newkirk, Oklahoma Territory. The inventor has devised a corn-sheller embodying novel features of construction that adapt it to shell corn from the cob in a rapid and perfect manner, screen and clean the shelled corn, remove the cobs from the machine, and likewise convey the shelled and cleaned corn outside of the machine. The portability of the entire apparatus attained by placing it completely upon a wheeled frame is of great advantage and enables the owner to shell the corn, clean it, and put the cleaned grain in bags out in the field during favorable weather, and thus avoid unnecessary handling of the fodder and husked corn.

HARROW. — William M. Baker, Fortville, Ind. This invention provides a simple and effective pivotal device for two harrow or toothed frames in a main frame and also a clamping device for the teeth which will not weaken the teeth-carrying bars, and while holding the teeth securely in place, will permit them to be vertically adjusted upon the bars. By means of a shifting device, the harrow or toothed frames can be independently adjusted up or down; and the teeth in the frames can be given any desired angle.

PLOW-FENDER.—Nicholas Steffes, Darlington, Wis. The plow-fender is essentially a weed-turner and is located at the land side of a plowshare. The fender is so constructed that it will prevent straw, manure, or weeds from being drawn forward with the plow. By preventing the rolling or dragging action of the straw, manure, and the like, such obstacles are covered better than heretofore and left evenly distributed, either in the furrow or at the edge of the next furrow. Thus the plow runs more lightly because it is always clean and free from rubbish.

BAND-CUTTER AND FEEDER.—Peter N. Petersen, Herman, Neb. The invention provides a very simple form of band-cutter and feeder which will spread every bundle the full width of the cylinder without tangling or feeding crosswise. By employing independent feed-chains there are no slats to work loose and break and less chance for loose grain to be carried back under the feeder to be wasted. When the cylinder draws the grain from the feeder, as it will when the grain is a little damp, that part of the grain between the chains will be drawn first by reason of the chains' firm hold upon the straw above them. Concave circular cutters are used, the front edges of which are brought parallel to one another, thus effecting an easy entrance through the grain.

Bicycle-Appliances.

BICYCLE-PATH SWEEPER. — Albin Voegele, S. W. cor. 59th Street and Park Avenue, Manhattan, New York city. Under the number 644,380 a patent has been granted to this inventor for an ingenious attachment to the front fork of a bicycle, which attachment prevents glass, tacks, and the like from puncturing the tires. During inclement weather the attachment clears the path directly in front of the wheels, thereby preventing the wheels from throwing mud upon the rider. The attachment can be controlled from the handle-bar of the bicycle, so that it can be lowered or raised at will while the rider is in motion. The device is light and can be easily applied to any fork.

Mechanical Devices.

HOIST.—Robert Rutter, South Butte, Mont. The hoist is especially adapted to be used for mining purposes and to be driven by horse-power. The novelty of the invention lies in peculiar clutch and pawl devices. The drum, mounted upon the frame, is moved by a clutch. A lever carried by the frame actuates the clutch. A ratchet is attached to the drum; and a pawl works with the ratchet to prevent the back movement of the drum when the clutch is in gear. The pawl is connected with the clutch-lever so as to disengage the pawl from the ratchet simultaneously with the disengagement of the clutch.

RAZOR-GRINDING MACHINE.—Joseph North, Harrison, N. J. It is the purpose of this invention to produce a small, cheap machine which can be used for hollow-grinding razors and similar tools. The machine comprises two opposed grinding-wheels adapted to engage opposite sides of the razor. The razor-holder slides between and beneath the wheels. A nut upon the razor-holder is adapted to engage a threaded shaft journaled beneath the razor-holder and having rotative connection with the grinding wheels. As the grinding wheels are turned, the razor is automatically fed by the threaded shaft.

STENCIL-CUTTING MACHINE. — Stuart B. Moore, Brooklyn, New York city. This invention is an improvement in stencil-cutting machines of the kind used in making paper stencils. The machine is designed to be used for cutting letters of more than one size. With this object in view, the disks which carry the punches and dies are provided with two circular rows of punches; and the punch-operating mechanism is adjustable so that it can be made to engage with the punches of either row.

FRICTION WARP-RACK FOR LOOMS.—William J. Irwin, Manhattan, New York city. The device is arranged to enable a weaver conveniently to regulate the tension of the warp, to dispense with the cumbersome weights heretofore employed, and to protect the warp as much as possible from dirt and dust by reducing the distance the warp has to travel from the rack to the lay, so that the fabric will not become streaky.

Miscellaneous Inventions.

FURNACE FOR DESULFURIZING ORES.—Henry Guyer, Casapalca, Peru. The furnace as constructed is intended to take the place of heap or stall roasting of lump ores of a size passing through a two-and-a-half-inch ring down to a three-quarter-inch mesh screen. A furnace, twenty-four feet in length, is capable of quickly desulfurizing from seven to ten tons of ore in about twenty-four hours, the ores containing over fifteen per cent. sulfur. Ores can be discharged in about two days, enabling the ore to be drawn from the bottom completely burned out and cold.

DEVICE FOR PREVENTING SHIPS FROM SINKING.—Francisco L De Villa. 7a A. S. No. 1, Guatemala, Guatemala. The invention consists of a series of cubical rubber compartments distributed throughout the vessel, the accordion-like structure of which permits their folding up. When brought into action they are distended with air kept compressed in suitable metal receptacles. When not in use they are closely folded against the under surface of the decks, and held in this position partly by atmospheric pressure and by electro-mechanical means, the sudden removal of which insures their instantaneous release. The moment a dangerous leak is sprung the stop-cock guarding the compressed-air receptacle is opened and the required amount of air is allowed to rush in and distend the compartments. When fully distended, the compartments buoy up the vessel.

REIN-HOLDER.—Franklin A. Ridout, Cynthiana, Ky. The rein-holder has clamping members pivoted together for clamping the reins between them, and a locking device locks the clamping members in an open position for the insertion of the reins. The locking device is arranged on the clamping members between their connecting pivot and their free ends, being thus adapted to be actuated by the operator's pressing the reins against it to unlock the clamping members for the latter to close and then automatically to clamp the reins. The rein-holder can be readily applied to the dashboard or other part of a vehicle.

GUN-SIGHT. — Peter Lawrence, Ouray, Colo. The sight can be readily elevated and centered and can be accurately guided in its movement. The vertically-adjustable sight-arm has a horizontal member split at one end; a sight is adjustably mounted transversely on the horizontal member, and an expanding-screw is arranged in the slit of the sight-arm.

COMPOUND LIP-VALVE. — Benedict Hübbe, Hamburg, Germany. The valve is compounded of several concentric elastic rings bent at the one border upward and fastened to seats arranged in a horizontal face; and the invention consists in arranging the concentric elastic rings one above the other, so that the whole valve is somewhat conical in shape. The object of the invention is to attain a larger area or sum of openings for the liquid to pass through than is obtainable with other valves having elastic rings in a horizontal face, and to strengthen the elastic rings in certain cases so that they will sustain a much larger pressure or head of liquid.

APPARATUS FOR CASTING METAL.—Joseph W. Harrison, Converse, Ind. A great problem for years in the steel-founding has been that of successfully making small castings from soft steel. The expense of conveying tons of molten metal from open-hearth furnaces in large ladles to small molds has been tedious and costly. The opening up of a large stream of metal into small molds soon clogs up the gate. When flasks are used it is necessary in shaking out to use small sledges and bars, and by continual pounding and digging the sand falls out. The present invention employs an apparatus by which a great number of castings can be made by one pouring of metal, and in which no flasks are used. The molten metal is caused to fill the molds completely.

NECK-YOKE AND TONGUE CONNECTION.—Arthur L. Gruggen, Moosomin, Assiniboia, Canada. This invention provides a simple neck-yoke and tongue connection which is adapted to swivel in all directions and to prevent accident in case of the breaking of other draft appliances. If the traces of either or both horses break, the neck-yoke connection can be relied upon to hold the pole or tongue and the neck-yoke swivel connected in a secure manner. As the ends of the neck-yoke are properly secured upon the harnesses, the team will remain attached to the tongue, and the vehicle will be drawn from the neck-yoke, if it be necessary for the safety of the occupants.

FIRE-ESCAPE.—Edward M. Christ and William I. Haldeman, Pine Grove, Penn. The invention is a friction device consisting of a tube inclosing a spiral strip, in the channels of which the rope lies. Either the rope or the tube may be attached to the building. The most effective frictional resistance is secured by the spiral strip. The rope is not injured by the spiral strip, for the channels have no sharp surfaces.

CAP FOR CHILDREN. — Benjamin Vendig and Alexander Schiff, Manhattan, New York city. These inventors have devised a cap or bonnot especially adapted for infants' or children's wear, so constructed that it can be laid flat, washed, and quickly restored to proper shape upon the head.

TAG. — Samuel J. Silberman, Manhattan, New York city. The tag serves the purpose of identifying clothing before it passes from the manufacturer. The tag is so arranged that it can be applied to the article of clothing to expose the article fully and yet permit its easy disconnection.

CURTAIN-POLE.—Almon S. Venen, Forest Grove, Ore. The pole is formed of two hollow, semi-cylindrical sections engaging each other at one end to permit their moving toward or from each other to engage and disengage the curtain. The sections are drawn together by a retractile spring, and are held in extended position when desired by toggle-links. The pole is a very effective and simple means for holding curtains and portières so that they will hang gracefully.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

PRINCIPLES OF MECHANICS PRESENTED IN A NEW FORM. By Heinrich Hertz, with an introduction by H. von Helmholtz. Translated by D. E. James and J. T. Walley. New York: The Macmillan & Company. 1899. 8vo. Pp. 275. Price $3.25.

The book before us is one which appeals only to those who are familiar with mathematics and who wish a thoroughly scientific discussion of the subject. The definitions, observations and corollaries are arranged in a concise form and the author shows by the lucidness of his definitions from his reasoning, the extraordinary fitness for producing a work of this nature. There are many who cannot read the monumental works of Hertz who will be greatly interested in the present book.

MONOPOLIES AND TRUSTS. By Richard T. Ely, Ph.D., LL.D. New York: The Macmillan Company. 1900. 16mo. Pp. 278. Price $1.25.

At the present time when there is so much interest exhibited in combinations of capital usually termed "trusts," a really enlightening book on the subject which should treat of it in a dispassionate manner, is sure to be appreciated. The author is Professor of Political Economy and Director of the School of Economy in the University of Wisconsin, and has made a special study of the subject. He has presented an original contribution to the economic theory which will be further developed in the future by others and by himself.

THE THEORY OF ELECTROLYTIC DISSOCIATION AND SOME OF ITS APPLICATIONS. By Harry C. Jones. New York: The Macmillan Company. 12mo. Pp. 299. Price $1.60.

The author who is an Associate in Physical Chemistry in the Johns Hopkins University, has taken up a difficult subject and has succeeded in his task with rare success. It has been written with a hope of supplying students with information which they would otherwise have great difficulty in obtaining, giving as it does the latest developments in the subject and he justly remarks that a student who has a fair knowledge of the origin of the theory of electrolytical dissociation, of the evidence upon which it rests, and its applications, have already acquired an elementary conception of many of the fundamental principles which underlie modern physical chemistry

THE GRAMMAR OF SCIENCE. By Carl Pearson M.A.F.R.S. Second Edition. London: Adam & Charles Black. 1900. 8vo. Pp. 548. Price $2.50.

The first edition of this work was published eight years ago and the views expounded in the former edition have met with wide acceptance. It is primarily intended as a criticism of the fundamental concepts of modern science. The author accepts, almost without reserve, the great results of modern physics; it is the language in which these results are stated that he believes needs reconsideration. We do not know of any book which will give the student in such concise form the broad facts which underlie modern science. It is a most valuable contribution to scientific literature.

WATER SUPPLY ENGINEERING. The Designing, Construction and Maintenance of Water Supply Systems, both City and Irrigation. By A. Prescott Folwell. New York: John Wiley & Sons. 1900. 8vo. Pp. 562. Price $4.

The author deals with a well-worn subject and he has acquitted himself of a difficulty with success which does credit to his professional standing. We note the omission of a preface which would give some account of authorities consulted or how the data was obtained. We have no doubt however of Prof. Folwell's figures and the book will undoubtedly prove of value to all municipal and hydraulic engineers.

VICTOR VON RICHTER'S ORGANIC CHEMISTRY OR CHEMISTRY OF CARBON COMPOUNDS. Edited by Prof. R. Aschutz. Authorized translation by Prof. Edgar F. Smith. Vol. II. Carbocyclic and Heterocyclic. P. Blakiston's Son & Company. 1900. 12mo. Pp. 671. Price $3.

The present volume is the second of a series and is the third edition from the eighth German edition. It is fully authorized. It is difficult to find words to praise this most admirable scientific book. It will not be of very much use to those who have not some knowledge of the subject, but to those who do it will be simply invaluable. It is a monumental work of the greatest importance and should form an addition to every chemical library.

A SYSTEM IN INSTRUCTION IN QUALITATIVE CHEMICAL ANALYSIS. By Arthur H. Elliott, Ph.D., and George A. Ferguson, Ph.D. New York: Published by the authors. 115 West 89th Street. 1899. 8vo. Pp. 155. Price $1.50.

The first edition of this book was published in 1892, and the third edition has now been called for. The original methods laid down have been excellent and have been adhered to in the present book but the field has been widened and the work has been made more useful by numerous editions. The tables are excellent and students who follow the directions laid down will certainly have little difficulty in acquiring facility in qualitative analysis. The book is well printed in large type.

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Notes & Queries

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(7838) H. K. asks: Will you please state whether a cablegram is received by the operator, by spark or sound? A. The messages oyer the ocean cables are not received by either a spark, or a sound, but are written on a strip of paper in motion by a stream of ink which flows from the fine tip of a glass tube which is moved to and fro by a coil of wire in obedience to the signals. This is called a siphon recorder. Another method which was employed at first was to read the signals by the to and fro motion of a spot of light which was reflected from the mirror of a very sensitive galvanometer.

(7839) H J. B. writes: In a 10 plate of 30 inches diameter Wimhurst machine is a brass tube of 2 inches outside diameter and ⅛ inch thick or 1¾ inches inside diameter large enough for prime conductors and the spheres on the end of the conductors 4 inches outside diameter and ¼ inch of metal or 3½ inches inside diameter with discharge rods $\frac{3}{16}$ inch diameter and the spheres on discharge rods 1 inch or 1¼ inches diameter. Why do they make the prime conductors of static machines so large and those of the induction so small in comparison? A. The old static machine had prime conductors of a size which are now known to have been of absurd proportions. At first a human body was supposed to be necessary for this purpose. Almost any sized rod or tube will answer, for a static machine either of the frictional or the induction type. The induction machine, either of the Holtz or the Wimshurst form, is a static machine as much as the oldest frictional machine. A static machine is one which accumulates charges of electricity. These are then used for any purpose desired, as sparks, etc. The metallic portions of all these machines need to be of no greater thickness than is necessary to give sufficient rigidity. The balls are often made of sheet metal spun up. The size of the discharging balls influences the intensity of the spark; 1 to 1¼ inches is a good diameter.

(7840) D. R. L. asks: What is the best method for preserving caterpillars and worms for a natural history collection? A. To preserve soft specimens for collections, immerse them in a solution of formalin in water of a strength not greater than ¼ of one per cent. This hardens the object; see Supplement, No. 1257, 10 cents. Alcohol will also preserve such specimens, but destroys the colors of them. Caterpillars may be preserved dry and mounted as are moths and butterflies, by first emptying them of their soft matter, and then stuffing the skin with cotton. This may have arsenic mixed with it in powder to prevent insects from eating the specimen, or the mounted object may be kept in an atmosphere of potassium cyanide vapor, as is usually done.

(7841) E. W. McQ asks: Would you be kind enough to give me a description of how to make a small "gasolene" engine? I am a boy who is fond of experimenting. A. You will find descriptions of such engines in our Supplement, No. 1024 and 1109, price ten cents each. Unless you have a good knowledge of the machinist's trade, we should advise you not to undertake to make a gasolene engine. It is a difficult machine to build, and requires good machinery to fit the parts as they should be. You would better begin upon something simpler, which will not be so dangerous to operate when you get it built.

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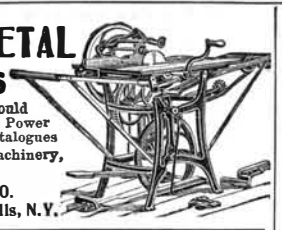

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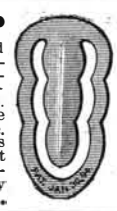

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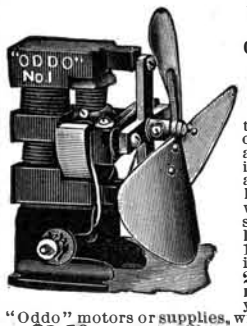

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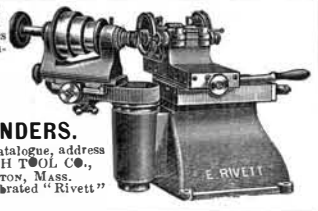

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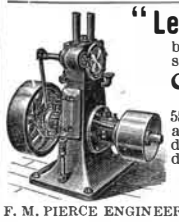

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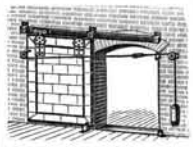

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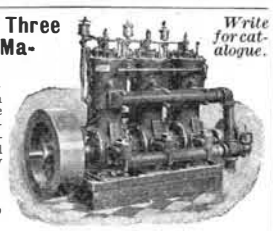

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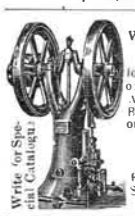

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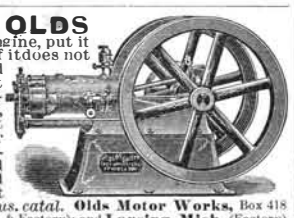

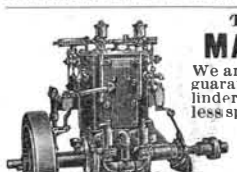

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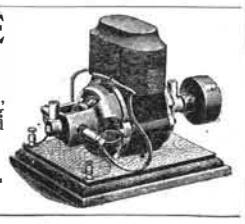

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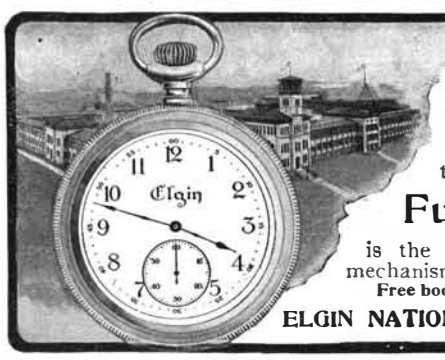

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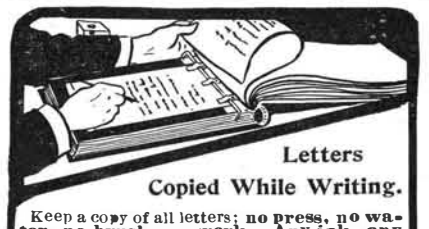

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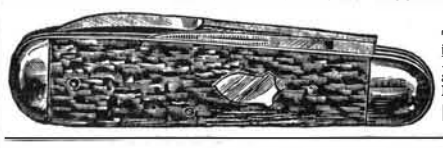

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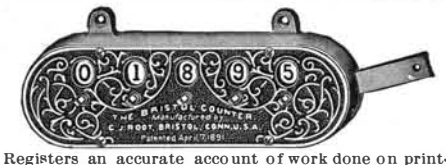

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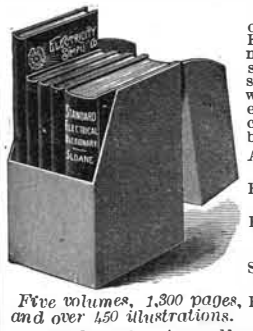

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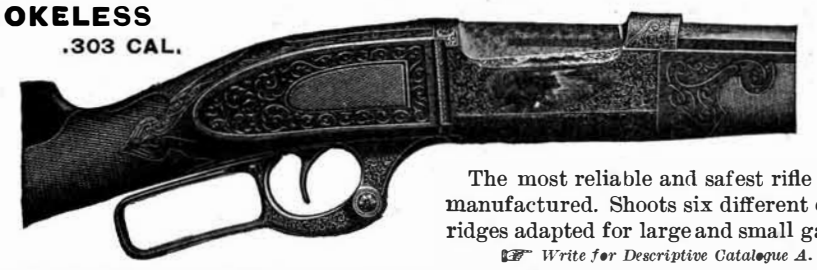

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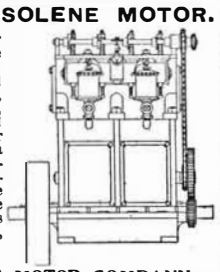

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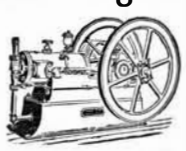

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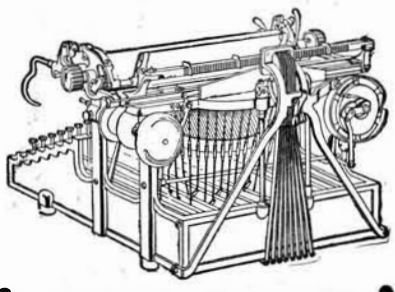

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